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SHAPE CUTTING

E. J. TANGERMAN
Assistant Editor

oxygen cutting origin, development, application in automatic equipment, advantages

First of several articles

MORE than a year ago, the editors of *American Machinist* began collecting information on the increasing use of the fabrication or "steel plate" method of building machinery and equipment. Although the process has become widespread during recent years, there has been no definite effort to present the process completely or to offer the shopman or the designer the information he requires for an adequate understanding of the principles, methods and equipment involved. Information so far published has been more or less unconsciously biased. All of this information has been surveyed by the present author, as well as a great deal of data hitherto unpublished.

During the past fifteen months, more than seventy sources have supplied photographs and information used in the compilation of the present series, some of them by request, others through submission of material for entirely different purposes. The information has covered fabricated products, methods, procedure, equipment and results. The present article will discuss gas cutting, its history,

Left to right: C. A. McCune, J. W. Gray, E. Vom Steeg, E. J. Tangerman, R. W. Boggs, and F. C. Whitney

The Reviewing Committee

Nine authorities checked the rough draft, five met as a committee to review the articles and illustrations

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A. F. DAVIS, Vice-President,
Lincoln Electric Company

ROBERT E. KINKEAD, President,
Robert E. Kinkead, Inc.

DR. A. KREBS, Consulting Engineer,
General Welding & Equipment Co.

CARLOS KREBS, Consulting Engineer,
General Welding & Equipment Co.

C. A. McCUNE, Director of Research,
Welding Engineering & Research Corporation

J. W. OWENS, Director of Engineering,
Welding Engineering & Research Corporation

F. C. WHITNEY, Sales Manager,
Air Reduction Sales Company

A. G. WIKOFF, Linde Air Products Company

L. R. BERKELEY, Sales Manager,
Una Welding & Bonding Company

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C. A. McCUNE, (Chairman) Director of Research, Welding Engineering and Research Corporation; Past President, American Welding Society and International Acetylene Association

ROBERT W. BOGGS, Mechanical Engineer,
Linde Air Products Company

JESSE W. GRAY, Arc-welding Specialist,
Westinghouse Electric & Manufacturing Company

EDMUND VOM STEEG, JR., Arc-welding Specialist,
General Electric Company

FRANK C. WHITNEY, Sales Manager,
Air Reduction Sales Company

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development, and basic principles. The next will discuss types of equipment for automatic gas cutting, adaptations of the method, and will offer some indication of what may be expected from gas cutting in the future. The third will take up the effect on metal of the cutting flame, and a comparison of gas cutting with other methods of metal cutting. The final article will describe the arc-welding process as applied to machine and associated construction, together with a description of the types of automatic equipment available, the distinctions between various types, and similar subjects. These articles, as finished, were reviewed by nine men who are considered authorities in this field, then corrected by the author and submitted for a committee reading by representatives of five different organizations. These men devoted an entire day to the final editing of the information and the selection of suitable illustrations from the great number submitted.

THE oxygen cutting process developed from the discovery that an oxygen jet impinged upon red-hot iron would "cut" it by causing the iron to burn in the oxygen and form magnetic oxide of iron (Fe_3O_4). Having a lower melting point than iron, this oxide fuses readily, forming a fluid slag consisting of the oxide mixed with a variable amount of molten iron, sometimes considered to be as much as 30 per cent. This molten slag flows, or is blown, away from the cutting zone, exposing fresh surfaces of iron to the action of the jet of oxygen, so that the cut can be continued as desired by the operator.

As in most thermo-chemical processes, there must be some means of setting the operation going. This is accomplished in oxygen cutting by the use of preheating flames which heat the starting edge of the metal to a bright red heat, acting in somewhat the same capacity as a spark plug in a cylinder—providing the ignition temperature. Actual cutting is done by the oxygen jet alone; in fact, the heat supplied by the heating flames is but a small percentage of the total heat created. In one Bureau of Standards 6-in. test cut, the preheating flames produced 6,048 calories per hour, while the combustion of the kerf iron in the oxygen produced 61,130 calories, or ten times as much. Theoretically, the heating flame might be removed after cutting has begun, but practically it replaces the heat dissipated to the air by the upper surface of the metal, and also provides a means of heating or removing rust, scale, paint or similar surface conditions which would otherwise tend to retard or even stop the cutting action of the oxygen jet. It is easily seen, therefore, that provided the gases used for preheating are capable of bringing the metal to an ignition heat, they have little effect on the actual cutting or severing process. The fuel gas used for preheating, however, has an appreciable effect on the time required for heating and is, therefore, very important on repetitive production work.

Speeds of cutting, sizes and capacities of tips and pressures of gases to be used are all obtainable in charts furnished by either equipment manufacturers or gas suppliers. Gas consumption and speed of cutting are relative to the thickness of metal to be cut and width of the kerf, i.e., to the amount of metal removed by combustion, or burning. A determinable volume of oxygen is required for combustion of a cubic foot of iron. This cannot be effectively supplied with one size of tip for different thicknesses of metal by merely increasing or decreasing the oxygen supply pressure to increase or decrease the rate of flow, except within limitations for each size of tip. The effective rate of flow or volume per minute is relative to the speed of combustion, and excessive pressures are merely wasteful of oxygen. The requisite volume of oxygen for different thicknesses of metal to be cut at efficient cutting speed is provided by graduated sizes of tips, each size having a rated flow capacity at specified pressures.

For cutting heavy sections, a greater volume of preheating flame is required than for light sections because of the greater heat radiation of the heavier metal. This is provided for with tips having several preheating jets of greater flow capacity or a ring preheating flame. Metal covered with rust, scale or paint also requires more preheating volume than clean metal. Greater speeds of cutting usually require larger preheating flames and give a rougher cut. The happy medium between smoothness of cut and speed of cutting is determined by the particular job. No general rule can be propounded; experience is, as usual, the best teacher.

The automatic shape-cutting machine was a logical development of the oxygen cutting process. It was soon discovered that many variable factors entered into manual cutting, and attempts to remove some of them resulted in linear guides, supporting wheels or guides to hold the torch to definite lines, or at a definite angle, or at a definite height above the work, and similar expedients. It was obvious that the human hand and ordinary methods of propulsion of the torch were not sufficiently steady, and the solution was some sort of automatic guiding or feeding device capable of holding the torch rigidly, driving it at effective and uniform speed, and yet allowing the flexibility attainable in cutting by manual means.

Sources of Information

Air Reduction Sales Company
Allis-Chalmers Manufacturing Company
American Blower Corporation
American Crane Company
American Institute of Electrical Engineers
American Society of Mechanical Engineers
American Society for Steel Treating
American Society for Testing Materials
American Welding Society
Babcock & Wilcox Company
Baldwin-Southwark Corporation
Bradley Machinery Company
Brown & Sharpe Manufacturing Company
Buffalo Forge Company
Chrysler Body Corporation
Cincinnati Shaper Company
Delning Company
DeLaval Separator Company
DeWalt Products Corporation
Dreis & Krump Manufacturing Company
Electric Arc Cutting & Welding Company
Electric Machinery Manufacturing Company
E. H. Ewertz
Federal Machine & Welder Company
Fusion Welding Corporation
General Electric Company
General Welding & Equipment Company
Henry & Wright Manufacturing Company
Hill Clutch Machine & Foundry Company
Hobart Brothers
Industrial Welded Alloys, Inc.
International Acetylene Association
International Nickel Company, Inc.
Link-Belt Company
Kearney & Trecker Corporation
Robt. E. Kinkead, Inc.
LaSalle Machine Works
Lincoln Electric Company
Linde Air Products Company
Lukenweld, Inc.
Modern Engineering Company
Murex Welding Processes, Ltd. (England)
New Britain Machine Company
Niagara Machine & Tool Works
Oilgear Company
Oster Manufacturing Company
Joseph C. Paulus & Company (German)
Philadelphia Gear Works
Republic Structural Iron Works
A. O. Smith Corporation
Thomas Smith Company
Steel & Tubes, Inc.
Steelweld Machinery Company
Sullivan Machinery Company
Swift Electric Welder Company
Thomas Spacing Machine Company
Thomson-Gibb Electric Welding Company
Torchweld Equipment Company
Una Welding & Bonding Company
United Engineering & Foundry Company
United States Steel Corporation
Utility Supply Company
Warner & Swasey Company
Watertown Arsenal
Welding Engineering & Construction Co.
Welding Engineering & Research Co.
Westinghouse Elec. & Mfg. Company
Dr. A. Wiss and others (Germany)
Wilson Welder & Metals Company
Youngstown Welding Company
And a number of other sources

Gas cutting with machines, providing for the mechanical movement of the torch, was developed in Europe about 1906. Two or three years later the General Electric Company took up the process in the United States and spent considerable money for exact study and for the development of machines and torches for its own uses. The expansion in less than ten years was so great that in one single war year this company saved about two hundred and fifty thousand dollars by shape cutting as compared with mechanical shaping. Other electrical concerns, steel mills, general manufacturers and shipyards soon joined the ranks for occasional work.

The earlier mechanical devices for cutting with the oxy-hydrogen and oxy-acetylene flames, while providing for mechanical holding and movement of the cutting torch or blowpipe, relied upon manual movement by means of a crank, wheel or similar device, or by lead screw and gearing. Furthermore, the movement was practically restricted to straight lines, circles or guidance by a templet; no universal movement was obtained, nor was there any assured uniform speed of cutting.

The first pronounced progress in mechanical gas cutting came with the development in 1911 to 1914 in the United States by the Davis-Bournonville Company (subsequently merged with the Air Reduction Sales Company) of several semi-automatic or automatic shape-cutting machines having a universal movement of the torch in a plane, propelled by motor at variable uniform speeds, and guided by manual tracing devices, cams or templets. These developments met with quick recognition of the possibilities for mechanical cutting.

The successful use of shape-cutting machines in railroad shops has been extensively promoted by the Oxweld Railroad Service Company which supplies this equipment in conjunction with supplementary annealing furnaces. With this well-rounded equipment, railroads were able to take care of many of their standard parts and duplicate them at a moment's notice by just keeping templets for standard parts in stock. Many railroads now carry from 100 to 300 such templets and have reduced their forging departments and storage space considerably. This step in machine cutting made possible quantity production with a highly diversified operation.

The field for mechanical gas cutting of shapes has been enlarged by the rather recent development of welding gas-cut shapes in fabricating machine bases and parts to replace castings. (*AM*—Vol. 74, pages 425, 499, 547, 582.)

The cut-and-welded process of machine construction has been called "one of the most outstanding developments in the history of machine design." Claims of fabricators briefly are: Purchasing, stockkeeping and storage are simplified through using only steel plates and shapes and preforged billets. Storage space for diversified patterns, foundry equipment, and the capital represented in them can be used elsewhere. Design is simplified through the low cost of cutting shapes instead of making patterns and getting castings in working up new designs. Machining time is cut down and some machining difficulties decreased, since shapes require little finishing and have only a thin hard coating through which a tool can cut easily. Packing and shipping time is cut through the lessened necessity for careful handling that results from greater structural strength. Fabricated machines have greater intrinsic strength than like units of cast-iron parts, and subsequent changes or additions can readily be made.

Under certain conditions, machines constructed of fabricated parts may be made stronger, lighter, and often at a lower cost. The resulting reduction in weight, of course, reduces shipping and handling charges. Weight reduction may be as great as 40 per cent over cast construction, averaging 50 per cent on gray-iron and 25 per cent on steel castings. Inventory reduction is illustrated by the case of a grinding wheel manufacturer. His inventory dropped from $20,000 to $5,000 for wheel guard parts when he adopted the fabrication method of guard construction. Standardization of grinding wheel guards is, however, lessening the difference between fabrication and casting costs.

The greatest argument for fabrication in the field of heavy machine manufacture is the same strength with decreased cost. If weight is cut 50 per cent in steel construction, the deflection may be about the same. Deflections in rolled-steel parts are about two and a half times less than those for castings (Modulus of elasticity of steel, about 29,000,000; of gray-iron castings, an average of about 12,000,000). This is an important factor where rigid construction is essential to increase tool life and the accuracy of machines. For example, cast presses were formerly large and heavy to compensate for the low tensile strength of castings. Consequently, if size limits were arbitrary, die space, depth of throat, and area of bed were reduced to gain the requisite strength. Fabrication avoids this difficulty. The fatigue resistance of steel is much higher, hence the cross-section of a cast press often is 60 per cent greater than that of a fabricated one to gain equal rigidity; even then the tensile strength and fatigue resistance may be lower. Construction of a typical fabricated structure, the Cincinnati Series 190 bending brake, has been illustrated (*AM*—Vol. 73, page 807).

In case breakage occurs, cast parts must often be entirely replaced for satisfaction; fabricated parts may be cut out and replaced by welding. Further, any section of a fabricated machine may be strengthened by adding metal to the weak portion, and the strengthening may be carried out by using fabricated gears and other parts. Construction time, also important, may be cut as much as 35 per cent. Also important is the difference in cost per pound between rolled steel and cast iron and also cast steel, since the cost of rolled steel is as a usual rule less than half the cost of gray-iron castings per pound, and usually around $\frac{1}{4}$ to $\frac{1}{7}$ the cost of cast steel. This advantage is, of course, in addition to the greater stiffness of steel over cast iron and, therefore, the possible use of less material.

Another increasingly important field for fabricated construction is in jig and fixture manufacture. Formerly built up of castings, they are now built of plate, at a time saving of from a half to two-thirds, and in lowering of maintenance costs as much as three-fourths. Cost of production has been lowered about one-fourth in certain cases, and in others, cost of steel production has been found to be about equal to the cost of the required casting patterns alone. There was at first some doubt as to whether arc-welded jigs and fixtures could resist warpage, distortion and the like. Several years' service in some of the larger plants has completely removed any doubts. Discussions of this branch of the development are contained in many papers, in fact too many to mention them specifically.

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Can incentives be applied to inspection? Answered authoritatively by the leading article in next week's issue

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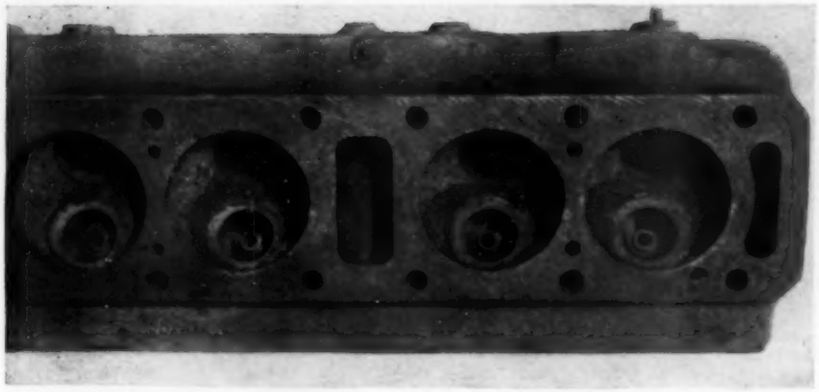
Electrical and heavy machinery manufacturers have taken up fabrication exclusively for use on their own products, but this means of fabrication is by no means limited to their use. One manufacturer of small machinery saved $1.00 per piece on an end ring for a small motor, a saving of about 35 per cent. Other companies are acting as jobbers, furnishing cut shapes to order. Yet others go a step further and supply complete fabricated parts and structures to order. Eventual fabricators who are hesitant in undertaking this work with their present limited experience need not hesitate further, as capable consulting welding engineers are available to render the necessary service.

Steel mills which have taken up the process seriously, partly for their own use, partly to supply their regular customers, are now in a position to furnish not only rolled shapes, but machine cut and fabricated ones. Foundries are not satisfied with simply improving their castings and equipment to compete with the trend; many of them are adopting the fabrication process to supply such customers as may prefer it. The foundryman's intimate knowledge of castings gives him an insight into what parts should be cast and what parts fabricated, an insight which other people can have with difficulty. The Watertown Arsenal is pioneering in this work for military uses, having demonstrated that in addition to the facility with which major developments may be gotten out, fabricated structures such as gun carriages possess an uncanny ability to withstand shocks with an appreciable reduction in weight.

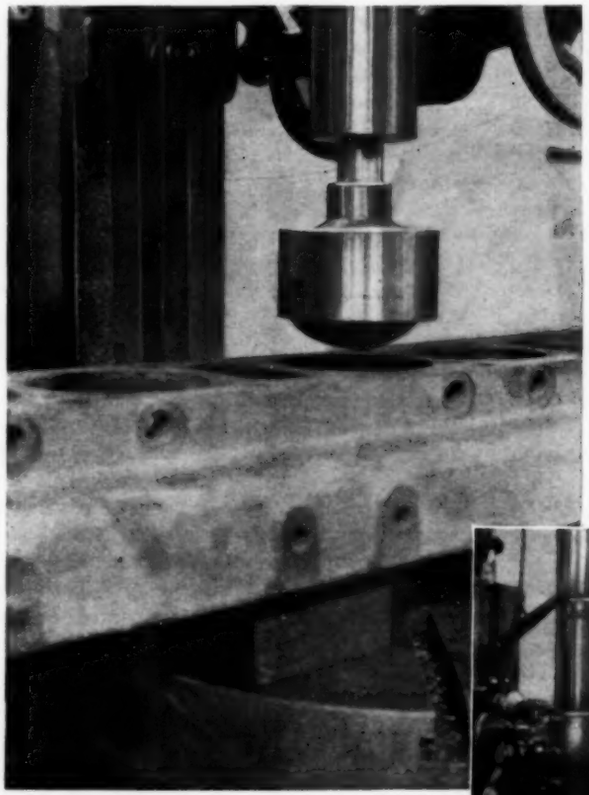
To stimulate interest in the development of cutting and welding and in recognition of outstanding welding achievements, such awards as the Miller Memorial Medal of the American Welding Society, the Morehead Medal of the International Acetylene Association, and the Lincoln Arc-Welding Prize competitions have been instituted.



A simple and inexpensive method of renewing valve seats has been developed by the Oakland Shops of the Pacific Greyhound Lines. Cast iron rods and an oxy-acetylene torch are used to rebuild the seats, as much as a quarter inch of metal being added if necessary. Usually only exhaust ports need refinishing, so intake ports are protected during welding by a round carbon plug driven into the intake valve opening. This shows the built-up head before refinishing

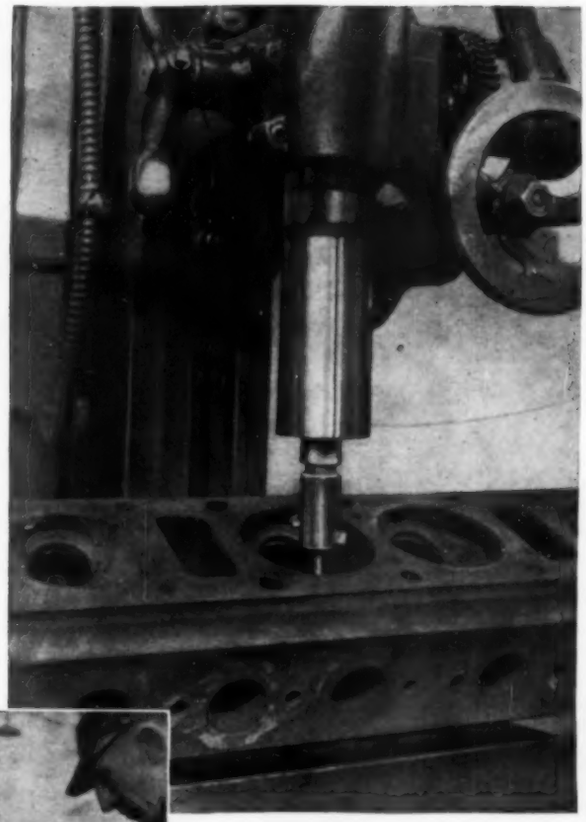
RENEWING BUS ENGINE

VALVE SEATS



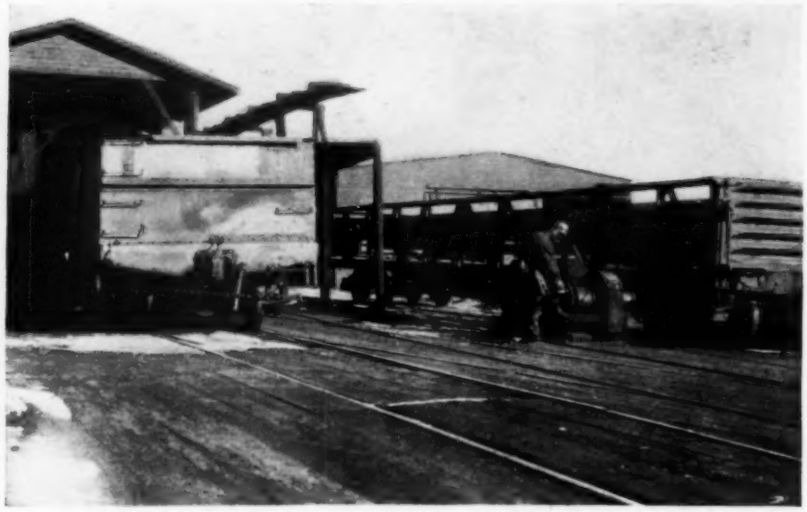
Refinishing is done by two self-aligning cutters in an ordinary single-spindle drill-press. Above is the first cutter, carrying a cutting bit on its lower face ground to cut the desired contour of the combustion chamber

In refinishing, the tool is fed with the "fine feed" of the drillpress, just as an ordinary counterbore. The cutter head is self-aligned as shown



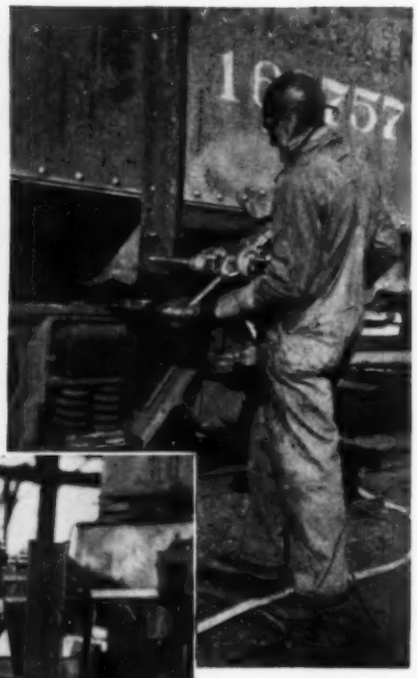
A tilting jig holds the cylinder head for cutting the valve seats with a counterbore, centered by a plug piloted in the valve-stem bushings. A finished port can be seen at the left. The counterbore may be adjusted for size to suit the type of head being refinished. After this operation, each valve seat is finish-ground by hand

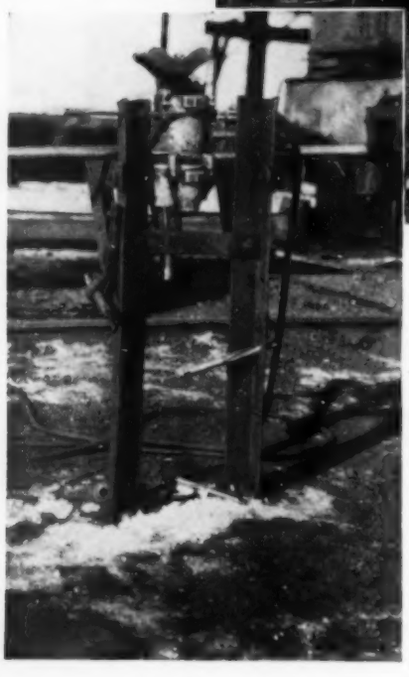
High - frequency electric units find extensive use on the outdoor repair lines at the Galesburg shops of the Burlington



PORTABLE TOOLS FOR CAR REPAIRS

Working in the brilliant sunshine of a cold winter's day, this man has no fears of water freezing in the air line. High-frequency electric tools have eliminated that bugaboo





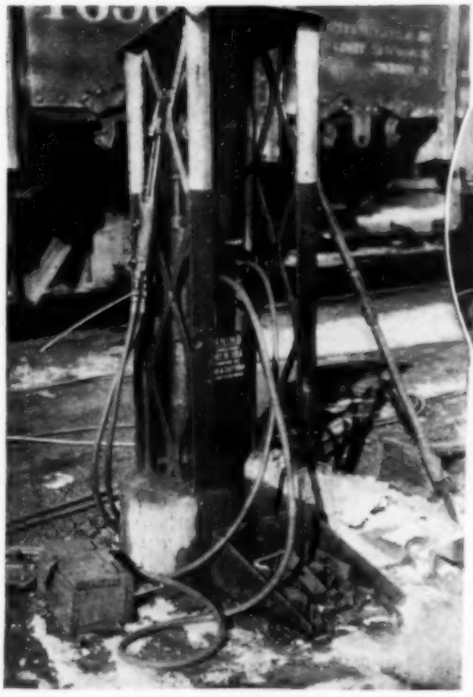
"Parking" a high-frequency reamer at the hitching post. Buried submarine cable brings in the "juice"

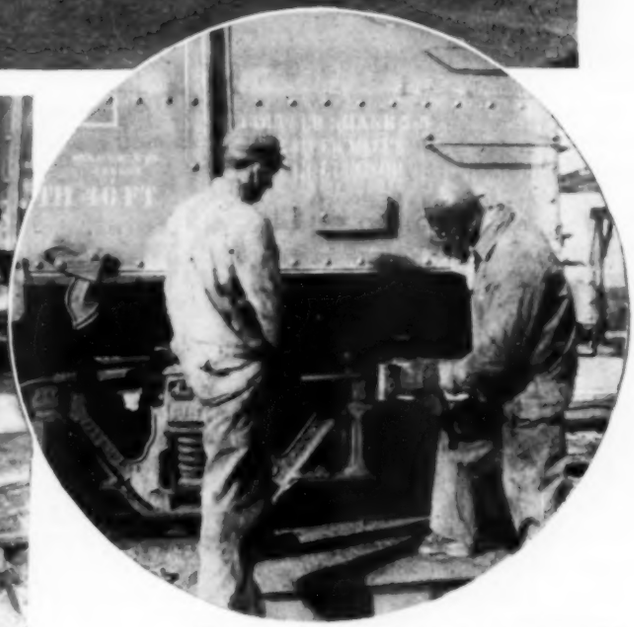
REPAIRS of all-steel gondola cars, composite coal cars, and single-sheet box cars call for pneumatic tools of various kinds, which, while satisfactory enough in mild weather, present some difficulties in operation at below-freezing temperatures, since most car work is carried on out of doors.

The C.B. & Q. car shops at Galesburg, Ill., are no exception to this rule, since even those portions of the work track that are under roof—constituting the greater part of the line—are open on all sides. The few salamanders scattered along the line may add to the cheeriness of the scene, but they don't help air pipes in which condensation has collected and frozen. No suitable substitute has been found for the riveting gun, but electricity has stepped in and solved certain problems in reaming, drilling, wood boring, and nut tightening. Powerful tools are required, and in order to keep their weight within economical limits it has been necessary to employ high-frequency motors. Such tools are almost universally used in automobile body work, but this particular installation is one of the first in a railroad car shop. Because they are light in weight, fast in operation, and always ready to go, even in the coldest weather, they are meeting the ordeal of this service with distinction, and stand up well under rough treatment.

Obviously, a frequency changer is required to convert the 60-cycle current, bought from the local utility, into 180 cycles for the tool. This means that an economical minimum number of tools must be operated to warrant the added investment in electrical equipment. At the Galesburg shops, there are four $\frac{3}{4}$-in. Chicago nut runners, sixteen $\frac{13}{16}$-in. Thor reamers, and eight $\frac{15}{16}$-in. Thor reamers. The small reamers also take care of wood boring in box car and composite coal car work. These tools take care of the $\frac{1}{2}$-in. bolt, which is almost universal, and are also capable of boring and nut tightening on $\frac{5}{8}$-in. bolts. Except for the eight large reamers, they are one-man tools. Faster speeds have made noticeable differ-

Flattening freight car hopper doors in a home-made press constructed from discarded air brake cylinders and structural steel





Heavy reaming operations in inaccessible places, such as on this center sill, are performed with two-man electric tools that have extended spindle shanks

Oxygen and acetylene are piped to convenient stations for use with the necessary cutting torch

ences in operating time, particularly with the nut setters.

Work with these portable tools is centralized near strategic outlet plugs and tool stands in the conventional progressive or spot system. For single-side box cars, there are twelve stations; for steel gondolas, ten. Cars are cabled together, 10 feet apart, so that they can be pulled as a unit at intervals varying from 20 min. to 1 hour, depending upon the class of work by an electric winch and cable.

Not all operations are done on the progressive system. Spray painting at the end of the line is excluded, as is the preliminary work, including stripping, replacement of trucks, and repairs to center bearings and bolster plates. A locomotive crane facilitates this work. Being a flexible unit, it serves to lift the car body while a repaired truck is substituted for the old one, or to drag the car along the track until it can be cabled to an auxiliary winch that pulls it through the area reserved for sand blasting. At this point the car is attached to the last car of the string, and thence progresses from spot to spot.

Aside from the electrical outlets at handy intervals, there are several piped outlets for oxygen and acetylene, as well as oil-fired box furnaces for rivet heating.

EXECUTIVE FORUM

Hours Gratis?

THE MANAGEMENT of the Express Machine Company placed high hopes in its new designs. It saw an opportunity to stimulate orders through the introduction of a line of machines which it firmly believed would be ahead of anything on the market. Accordingly, orders had been issued to spare no effort to advance the designs all possible. The responsibility for this work fell upon Ralph Cary, the company's Chief Engineer.

"How's the big job coming?" asked Horace Miller, President of the Express Machine Company, as Cary dropped into his office late one afternoon.

"Fairly well," said Cary. "But not quite fast enough to suit me. To speed things up, my department will work until six-thirty beginning next week."

"Good," approved Miller. "Anything that will push those drawings ahead will mean orders and profits for the company."

"One question has come up that I didn't anticipate," said Cary. "Several men have asked whether they'd be paid overtime for the extra hour and a half each day."

"They ought to know by now that our salaried employees are not paid overtime," said Miller. "I'd think they'd be glad to have enough work to keep busy. Many concerns have drastically cut their engineering departments, and at least one I know, has put its men on a four-day week. But I suppose it's human nature to be dissatisfied. Men have either too much work or too little."

"Their argument is that the shop force gets paid for it's overtime, and they feel that they're entitled to it also," said Cary. "As one man put it, the extra time is really their own which is being drafted for the company's benefit. We don't ask a man to work on a lathe an hour or so extra for nothing. Is a drawing board so much different?"

"The entire status of the engineering department differs from that of the shop," said Miller. "The shop man is paid by the hour; each minute of his time is charged against the product. The engineer is paid by the month, and we do not guarantee to limit the week to any definite length."

"The week is fixed by precedent," said Cary. "The real point is that the men feel that they earn this pay and are entitled to it."

"Do they stop to consider that they get two weeks' vacation with pay, which the shop men do not?" asked Miller. "Their employment is steadier year after year. I feel that your men should have a different attitude toward their work. They should be working to complete a job not merely to put in so many hours."

"That may be," said Cary. "But there is little incentive for a man to put in extra time when he doesn't profit by it. It is doubtful whether this overtime will accomplish much unless there is something in it for the men."

"If that's true, there's something radically wrong with their attitude toward the work," said Miller. "A man in an engineering capacity should take pride in doing his work well. When called upon, he should be willing to exert extra effort to promote the company's welfare. We are spending a considerable sum in these new designs as it is. The company can ill afford the burden of additional salaries."

"If you object to a cash award," suggested Cary, "how about crediting the extra hours to each man's vacation. That would give them some return without increasing costs. We would merely be borrowing against future working hours."

"Vacation credit is less objectionable than a cash outlay," said Miller, "but neither should be necessary."

Suggested by J. W. Hesketh,
Coventry, England

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What Do You Think About This Problem?

Payment for overtime is widely recognized for the shop. Is there any reason why the principle should not be extended to salaried workers? Many firms have no form of compensation for the extra hours of salaried employees while others reward this effort by increases in pay or special privileges. Are the advantages of a salaried position sufficient to compensate for extra time without additional remuneration?

. . . Discussion
of Executive Problems

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Dealer or Direct?

EDITOR'S NOTE: Several weeks ago, under the above title, the question was raised as to the relative merits of two methods of merchandising machinery. As a number of our dealer friends have some definite ideas on the subject, this week's discussion will be devoted to abstracts of their letters.

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We cover a wide territory in which is in operation less than 3 per cent of the country's metal-working equipment, according to *American Machinist's* 1930 Inventory. In this territory, we operate four men exclusively on machine tools and seven additional men, all of whom have some training in this line, and to whom we offer incentive to originate inquiry. It is surprising what they bring in, not only in the way of inquiry but in actual orders.

There are in the St. Louis metropolitan area alone, approximately 700 users of metal-working equipment and as many more in the outlying territory. Consider the problem of keeping in touch with all of these. It is apparent that for one man the task would be hopeless and no manufacturer has up to this time maintained more than one salesman in this territory, because the potential market is less than 3 per cent of his total output. The answer is that he loses many opportunities which would be his if he had efficient dealer representation. We are quite certain that the same argument holds good everywhere.

The Associated Machine Tool Dealers is organized to improve marketing conditions and the ethics of the industry. This cooperation is enabling dealers to offer better representation to their manufacturers than ever before.

—J. W. WRIGHT, *President, Colcord Wright Machinery & Supply Company.*

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You classify the machine tool dealer as a middleman. His lot would be fortunate were he a middleman only. The middleman merely passes the order to the manufacturer and takes his profit. That will come later for the machine tool dealers, but only in Heaven.

Situated on the Pacific Coast, we know that direct representation of machine tool manufacturers will not work. In the first place, there is not volume enough to warrant direct representation of a single line of tools or any particular group that is now working under one heading. This has been tried several times in this territory and has invariably caused a loss to the manufacturer so represented or forced him to handle other lines than those of his own manufacture.

Direct representation is good only when the direct representative is working under an agent. In some cases, the direct representative of a factory is not a salesman, but an expert mechanic or mechanical engineer endeavoring to do sales work. Some of them are of course very successful; others leave a great deal to be desired.

There are times when a direct factory representative will be on the job and lose out on an order. The loss of his equipment may mean the standardization on the competing line. Every call that he makes will bring out the same statement that the firm has standardized on the other make. With this condition the factory man is practically stalled unless he can produce some radical change in design or production. The dealer, however, will call not only in the interest of his other lines, but on each trip attempt to break down the resistance to the line he is offering.

Another weakness of direct factory representation is that there is not today, with the possible exception of one or two, a manufacturer who covers a complete line of tools. Take lathes for instance: one manufacturer will handle lathes only from 14 in. to 30 in., while the inquiry might cover 24 in. to 48 in. A direct factory representative would be assured of competition coming into consideration with a good prospect of his work being upset through the desire of the prospect to purchase all the equipment of one make.

—H. L. BROWNE, *Harron, Rickard & McCone Company.*

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The dealer is not only in close touch with the trade in his territory but is also perfectly capable, through engineering ability, of giving the same service to his customer as a factory representative. We know from experience that the customer invariably depends more on the dealer for information than he does on the direct representative. The visits of the dealer are more frequent; better acquaintanceship is enjoyed; and customers feel more free to ask for information. Therefore, we are strongly of the opinion that the marketing of machine tools is better handled by dealers, especially those who are recognized in the trade.

—A. R. STEDFAST, *President, Stedfast & Roulston.*

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Every wide-awake machinery dealer spends considerable money advertising manufacturers' machinery in his territory. Machinery dealers generally have a corps of salesmen who are engineers. These men are immediately available for consultation and advice at all times, thereby providing greater facilities for keeping in touch with prospects in their territory than has the manufacturer. Because of the various lines which the dealer handles, sales expense is pro-rated, with the result that sales costs are lowered.

In a general time study of selling, one of the nationally known manufacturers discovered that their salesmen were distributing their time as follows: 40 per cent in traveling, 20 per cent in waiting, 25 per cent to clerical and miscellaneous duties, and only 15 per cent to sales conversation in the actual presence of prospects. Using this analysis as a basis, one outstanding feature is readily observed to be in the dealer's favor—that of traveling. In our own organization, we have about thirty field men

covering the Detroit territory, thereby contacting with our customers every few days. This is made possible and profitable due to the varied lines carried by the dealer, but would be ruinous to the manufacturer.

In selling direct, the manufacturer is often called upon to assume heavy credit burdens and considerable accounting expense. When selling through the dealer, this is eliminated, as the dealer performs this service. The dealer should have a much better conception of the consumer's ability to pay for machinery purchased. If a survey were made, machinery manufacturers would find that their losses in the past, in selling through dealers, have been infinitesimal—probably not more than one-twentieth of one per cent; whereas, in selling direct, machinery manufacturers frequently find themselves confronted with losses through bad accounts. Many small manufacturers have been able to start in business because of the credit extended to them by the dealer.

—D. C. HENDERSON,
The Chas. A. Strelinger Company.

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It should be much easier to anticipate costs and therefore more closely budget all expenditures through dealer organizations. In times of general low sales volume, it is right and proper for a business organization to use every effort to bolster sales; and this is true of machinery manufacturers as well as other lines. The cost of sales naturally increases with lowered volume, and these costs are reflected in dealer organizations as well as in manufacturers' sales organizations.

In times of lowered sales volume, more manufacturers look to dealers for distribution in order to keep their sales expense as low as possible; why then should they expect to get the lion's share when business is good and can be handled, with the exception of a few special lines, just as well then by the distributor as any other time.

The "buy at home movement" is a greater handicap to direct sellers in times of depressed business condition than at other times. Some state and municipal governments have gone so far as to pass laws preventing purchases from out of city or state concerns and naturally those manufacturers who are not represented by local dealers are eliminated from consideration. Most cases of complaint do not come from a gross fault of a machine, but are more mental than otherwise and can be taken care of by a dealer with diplomacy just as well as direct agent.

—LEO H. GORTON, *President,*
Machine Tool & Supply Company.

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There are about 25 lathe manufacturers, 31 tool and cutter grinder manufacturers, about 40 drilling machine manufacturers, 15 horizontal boring, drilling and milling machine manufacturers, about 18 milling machine manufacturers, 22 tapping machine builders, about 20 thread-cutting machine manufacturers, 49 builders of special machinery and tools, and a similar ratio on all other lines of machine tools built.

What constitutes direct selling? The answer is to give real service. If you eliminate the dealer, every machine tool manufacturer in the United States of which there are thousands, must have an office in every principal city of the United States and Canada and must employ in such an office at least two salesmen and a stenographer. One salesman would have to be the inside man to answer the telephone calls and take care of customers when they called to see him and be in a position to answer them intelligently. The other would have to travel, calling upon the trade. If a stock of machine tools is maintained at the same time, such as the majority of dealers carry, it would involve many more expenses such as show rooms, investment in the machinery itself, freight and drayage investments, servicing, carrying charges, shipping clerk, stenographers, bookkeeper, serviceman, telephones and general overhead.

Direct selling would mean that several thousand offices with at least twice that many salesman would be located in every principal city of the United States. It stands to reason that there would not be enough business in each territory if there were several thousand machine tool offices.

Large dealers in fairly large territories have from ten to twenty salesmen on the road. Each man is allowed his territory and it is up to him to canvass it thoroughly, not overlooking any bets. Of course, it is true that he has other lines to sell, but, nevertheless, he is making his calls, keeping in contact with the trade and securing inquiries.

—C. A. HERBERTS, *President,*
Herberts Machinery Company, Ltd.

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There is absolutely no question but that any machinery company, building up a high-grade mechanical selling force, will serve the manufacturer better than it is possible for him to do by direct selling methods. It is important that concerns of our character have salesmen of real mechanical ability. By so doing, they become an arm of the various manufacturers whom they represent and are thereby able to go into details of the customer's requirements on an intelligent basis.

The dealer is able to cooperate and know the real conditions regarding special credit information which frequently arise. A further advantage to the manufacturer by being represented by a dealer is that on inquiries, he can make much quicker contact which is highly important.

—H. A. SMITH, *President,*
The H. A. Smith Machinery Company.

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Assuming that the manufacturer has made the proper selection of his dealer, he is assured of intelligent and forceful effort in the sale of his product. He is assured of payment in accordance with fixed terms, usually thirty days or less. He is relieved of this necessity of granting extended terms, a great deal of accounting, collections, and absorbing bad accounts. He gets greater and more uniform representation. The dealer is local, he operates in a restricted territory, he builds up an organization of trained men who are "at home" with their customers. The individual direct salesman has comparatively few customers with whom he becomes well acquainted. The dealer representative calls much more frequently than the manufacturer representative, and usually he has freer access to the shop. If at work on a given transaction, he invariably looks around and endeavors to develop business in other lines.

The dealer salesman is undoubtedly responsible for more changes in design and new developments than is the direct salesman. He is a man of more diversified ideas; the direct salesman, a man of one idea. The dealer salesman utilizes the knowledge and developments of a number of manufacturers, the direct salesman of

one manufacturer. The charge is made that a dealer does not do missionary work and is concerned only with the quick sales and profit; nothing is further from the truth, the dealer salesman does an enormous amount of missionary work. —*Name withheld by request.*

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If the two systems were measured on their merits, it would be found that dealer representation is the best. If a company used dealers throughout the entire territory or sold direct through the entire territory, the balance would be in favor of the dealer. A well-trained, intelligent man handling a number of lines can save a lot of time for a buyer over the time required for special men for each of the several lines. Quite a prominent specialist in the medical profession made the statement to me just recently that specialists in medicine these days perhaps know more about some things than their general practitioner brothers of some years ago but know considerably less about the general profession. He admitted that a thoroughly competent, old-fashioned general practitioner could oftentimes give better and cheaper advice than the highly trained specialist. —H. E. Oatis, *Toledo Branch Manager, The National Supply Company.*

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When the customer runs into trouble or needs service, he much prefers reaching for the telephone and calling someone who can get there in the shortest possible time, as breakdowns are costly. The rendering of service produces a good feeling with the customer that oftentimes results in nice inquiries.

The manufacturer, who is represented by a jobber, has practically a fixed selling expense. The jobber, in handling several different lines, often has contact with several important men in an organization, whereas the manufacturer, if handling the inquiry direct, would probably go to the chief official. In this way, the jobber can build up an interest in a certain tool, and get the support of the foreman, toolroom foreman, superintendent, or even factory manager.

Very rarely is it necessary for the jobber to call on a manufacturer for assistance. The manufacturer, by having one or more sales engineers available for this work, can furnish this information, and the jobber can proceed with the deal. The jobber is in a much better position to handle credit papers, such as notes and mortgages, on their particular customers than any manufacturer would be.

One of the most important features is the handling of used machinery. Few manufacturers selling direct take in used equipment, and this has been the medium of a great number of sales for the jobber.

—George C. Wiseman, *The Cleveland Tool & Supply Company.*

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The dealer stands in the same relation to his customers as a doctor to his patients. He is wholly unbiased in the recommendation of a particular kind of machine to do a certain job. From his wider experience with a great variety of tools, he is more competent to judge his customer's requirements and to advise him of the methods to be used. On the other hand, the direct seller will propose his own machine only, and if he cannot persuade his customer to take it, has no further interest in the subject. After a customer's needs are determined the dealer is constantly available to advise in operation, to iron out difficulties that may be encountered, and to represent him in any circumstance in which the factory may be at fault.

Maintaining a direct selling office is much more expensive than the cost of dealers' commissions. In active machinery market or a territory of concentrated buying, a direct office would undoubtedly show a profit but that is only a temporary condition. When the volume of sales decreases the loss more than offsets any gain. Dealers and their salesmen have in recent years made long strides forward in their knowledge of machine tools and in methods of salesmanship. This is indicated by the code of ethics of the Dealers' Association and by the serious responsibility the dealers feel both toward the factories they represent and to their customers.

—Homer Strong, *President, Homer Strong & Company.*

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Cash or Check?

About two years ago, our company inaugurated the "Pay by check" system in this city. At the time, there was much opposition from the employees because they said they could not cash their checks, as the banks were closed when they were at leisure. So arrangements were made with a number of banks to operate after regular business hours. In the envelopes with the first week's pay check, the company inclosed a circular explaining the reason for the change, where and how to cash checks, advice regarding checks lost, and what not to do with checks.

The banks say that the checks system has brought them many new accounts and much more business is being done by private check than it had before the check payment was inaugurated. The number of checks that are cashed by merchants is relatively small and I have not heard of any being cashed by any so-called speakeasy although this may be done in a few instances.

—William C. Betz, *Master Mechanic Fafnir Bearing Company.*

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No Change

It is inconsistent with American ideals of freedom to allow employers to conspire in preventing a man from changing his job when he wishes. Economic conditions erect enough hindrances to the fulfillment of ambitions without creating artificial barriers. Perhaps it is for the man's best good to keep his job rather than change. But who can say that the employer may judge this better than the employee? The plan is supposed to work against drifters, but it is unlikely that this is the class that an employer is trying to hold. Rather, this is the type he is trying to keep out.

It has been brought to my attention that employers have a method for getting around an agreement not to hire men unless they are released from their previous jobs. They tell a man to give up his job first and then they will consider hiring him, intimating that he will be sure of the job. So there seems to be little justification for such a scheme.

—Harrison G. Brown, *Supervisor of Standards, Crompton & Knowles Loom Works.*

Preliminary shop practice in the apprentice school

REPRESENTATIVE APPRENTICE SCHOOL IN POLAND

A. P. GWIAZDOWSKI
Ass't Professor, College of Engineering, University of Michigan

APPRENTICE training is still receiving considerable attention from industrial leaders. At the last annual meeting of the American Society of Mechanical Engineers, a number of papers were presented dealing with the training of apprentices, and one entire session was devoted to this subject.

Manufacturers of other countries have similar problems, and it is interesting to know how they solve them.

The writer was called, in 1919, to organize a machine-tool industry in Poland. One of the obstacles in the way of this work was the difficulty of securing experienced machine operators and machine draftsmen. In view of this, the management decided to organize an apprentice training school the main objective of which would be to train boys for the company's factories. A building for this purpose, was designed, built and equipped with American-made machine tools. It is still in active operation.

Graduates of public schools are admitted by presenting proper school certificates, but sons of employees have preference. Each student is required to pay 100 zlotys per year, or about a dollar per month as a tuition fee. The following subjects are taught: mathematics, including algebra, geometry and trigonometry; mechanical drawing, divided into sketching, detailing, assembling and simple machine layouts; shop practice, such as chipping, filing, scraping, drilling, shaping, milling, planing, turning and grinding.

Exercises are arranged in such a way that all products are sold. Students are graded on care of tools and machines, accuracy and speed. The instructors are not supposed to correct the student's work or to do his work by the way of "showing." The factor called the "variety of work" or "short time tasks" was found to be the most successful. The boys do not have so long to wait to see their jobs completed. Psychologically, this method seems to produce excellent results.

The classroom work takes up foundry, pattern-making, forging, heat treatment, construction of machine tools, and inspection. Cost accounting and time and motion study are also taught. Industrial physics, such as forces, friction, energy, prime movers, practical electricity, and the A-B-C of strength of materials are also a part of the course. Metals used in machine construction are discussed, and, finally, citizenship and hygiene are taken up.

The above program shows that the school was well planned. The annual reports show the following:

Year	No. of Students	No. of Graduates
1924	75	13
1925	95	13
1926	115	16
1927	142	19
1928	156	24
1929	170	33

The graduates are admitted to the company's machine

shop or drafting room where they stay for one year, during which time they are paid a certain wage. At the end of this period, they must take the final examination in order to receive a journeyman's certificate.

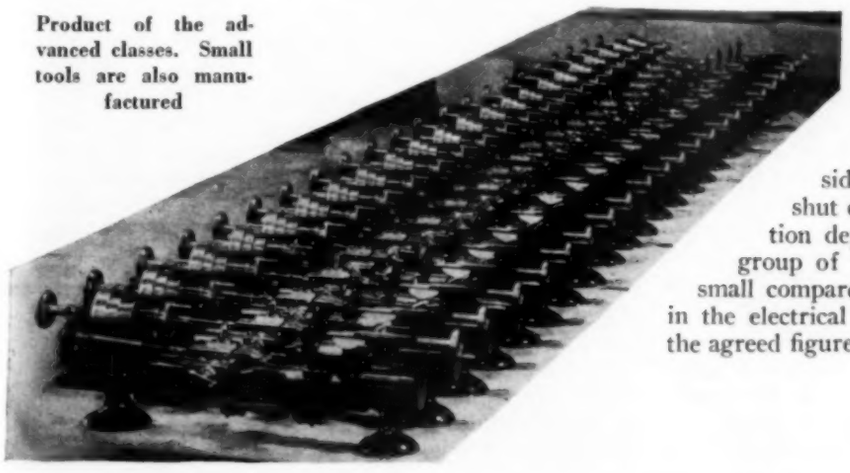
It is interesting to know what becomes of the graduates. The director's report shows that fifty are serving their shop apprenticeship; twenty-six are regularly employed as machinists and tool makers; eight are in drafting rooms; five hold administrative positions; five are manual training instructors; five serve their time in the army; and the rest are employed by Warsaw shops. As the work progressed, and increased capacity became necessary for the last year boys, the management built a large shop and equipped it with machines and small tools, making of it a small factory, where tools, such as hammers, dividers, calipers, punches, scribers, toolmakers' vises, and wrenches, are made. Later on, the apprentices make machine parts and build complete machines.

In 1928-1929 the total expenses of the school amounted to 154,137 Zl., or 670 Zl. per student. Translated into dollars, the education of one student, in 1929, cost about $75.

Mr. J. Gomulinski, the director of the school, told the writer last summer, and educators not connected with this school confirm his statement, that the Polish ministry of education, and manufacturers at large, consider the institution as a model for other schools of similar character.

In the writer's opinion, there are two important subjects in the above curriculum which are omitted in our own apprentice system, citizenship and hygiene. In Poland they teach apprentices history and geography. They arrange excursions in the summer time to different parts of the country. They tell the boys what the duties and rights of a citizen are and inform them about government. The teachers consider this knowledge just as important as trade skill and intelligence. In other words, they prepare not only mechanics and draftsmen, but intelligent citizens as well.

There was a time in this country when apprentices were difficult to get. But that was at a time when the attraction of the machinst trade was below par. That same thing may come to pass in Poland, but at present, the glamour of mechanized industry and five-year plans have invaded Southern Europe, and parents are eager to have their sons learn this new conception of industry even though they have to pay tuition for the privilege. Sometimes a thing that is paid for is held in greater esteem than that which is given free.



Product of the advanced classes. Small tools are also manufactured

Small Losses That Eat Up Profits

NOW that manufacturers are trying to make every penny count, it is a good time to make a study of needless expenditures for plant service. Joseph T. Ryerson & Son, for example, found it could readily save thousands of dollars a year by studying and eliminating needless water waste.

First, an anaylsis was made of the uses of water that ran through any meter; all leaks were run down and eliminated as far as could be seen. In one instance, however, even with all possible curtailment, the water bill was not materially reduced. A second and closer check revealed a serious leak that had been going on for years. In dynamiting the foundation of an old machine, a pipe had been ruptured and many dollars worth of water was being lost each year.

Considerable water was being used in flushing urinals throughout the plant. Operation was by automatic valves that worked at regular intervals not only during the day, but at night and on weekends. By installing hand valves at strategic places, it was possible to shut off these systems each night, thus cutting down the flushing time from 168 to 57 hours a week. Furthermore, where it was possible to do so without impairing sanitation, the period of flushing was reduced.

The company operates an 8-ton ice machine for use in the kitchen and for drinking water. Additional economy was gained by re-using the cooling water of the ammonia condenser in other parts of the plant.

Similar wastes were found in lighting, particularly at night, when the watchman made his rounds. In making his inspections he used the main room lights, and on the average half the lights in the plant were burning all night long. By installing snap switches at both entrances of a large room and wiring these switches to needed lights only, considerable economy was effected. As he passed through each room or section, the watchman turned out the lights behind him, where in the past he often did not or could not return to the main switchboard.

But the largest saving in consumption of electricity was attained by eliminating or reducing peak load charges. On dark winter days, the peak demand was between 11 and 11.30 a.m., owing to a combination of power and lighting loads. Starting the lunch hour of the section of the plant using the most power at 11:15 eliminated the danger of the peak being exceeded by a considerable margin. Accurate check is maintained by a demand meter. Should the danger point be reached the air compressor switch is pulled as the reservoirs will carry sufficient pressure to operate the plant for a short interval. Should further action be necessary, large machines drawing considerable power, such as friction saws, are shut down after consultation with the production department. This may involve making a group of workers idle, but the loss in output is small compared with a year's penalty of an increase in the electrical demand rate incurred by overstepping the agreed figure.

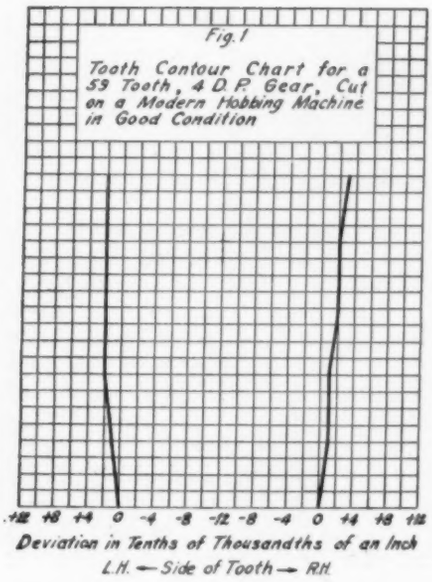


Fig. 1
Tooth Contour Chart for a 59 Tooth, 4 D.P. Gear, Cut on a Modern Hobbing Machine in Good Condition
+12 +8 +4 0 -4 -8 -12 -8 -4 0 +4 +8 +12
Deviation in Tenths of Thousandths of an Inch
L.H. — Side of Tooth — R.H.

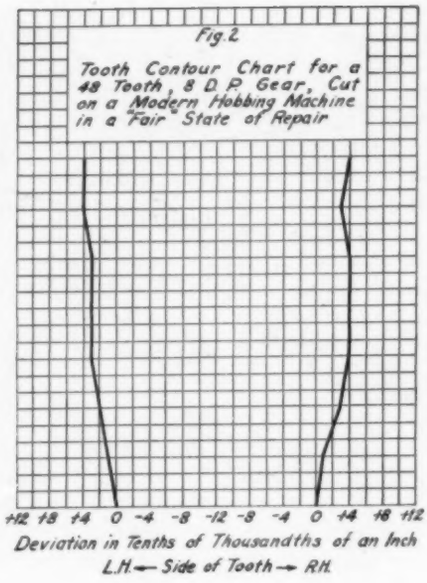


Fig. 2
Tooth Contour Chart for a 48 Tooth, 8 D.P. Gear, Cut on a Modern Hobbing Machine in a "Fair" State of Repair
+12 +8 +4 0 -4 -8 -12 -8 -4 0 +4 +8 +12
Deviation in Tenths of Thousandths of an Inch
L.H. — Side of Tooth — R.H.

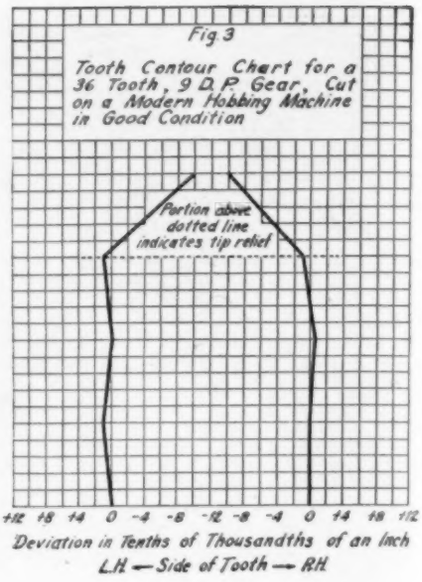


Fig. 3
Tooth Contour Chart for a 36 Tooth, 9 D.P. Gear, Cut on a Modern Hobbing Machine in Good Condition
Portion above dotted line indicates tip relief
+12 +8 +4 0 -4 -8 -12 -8 -4 0 +4 +8 +12
Deviation in Tenths of Thousandths of an Inch
L.H. — Side of Tooth — R.H.

Manufacturing Gears for Continued Accuracy

Discussion

In Vol. 74, page 500, A. B. Cox pointed out some possible sources of inaccuray in gear cutting. The present author believes that the examples presented were not representative of modern practice. He describes certain refinements that manufacturers of gear cutters have designed into their product for the machining of better gears

GRANGER DAVENPORT
Research Engineer, Gould & Eberhardt

THE charts in A. B. Cox's article, illustrating errors in tooth contour obtained under various conditions, convey a misleading impression of the present art of gear cutting. One outstanding fault is that they are plotted in units of thousandths of an inch. In the experience of the writer with similar charts, it has been customary to use tenths of thousandths as units; the necessity of this is obvious to anyone familiar with gear cutting practice. From some of these charts, which reveal an error in tooth contour of two to four thousandths of an inch, it is apparent that an obsolete type of hobbing machine must have been employed, for they are very poor examples of what is accomplished with modern gear cutting equipment. This is also apparent from the two machine diagrams accompanying the article which illustrate a large number of unnecessary gears in the trains of the hobbing machines discussed therein. To avoid any possible misconception, a few samples of gear tooth form variations produced by up-to-date equipment are submitted.

The three charts, Figs. 1, 2 and 3, illustrate examples of gear tooth forms produced on hobbing machines. They are plotted from readings taken on several gear tooth contour testing devices on the market. The deviation from the theoretically correct contour is plotted horizontally, and the corresponding positions as measured above the base circle are plotted vertically. A chart for a gear tooth, having theoretically perfect contours on both sides, would be represented by two straight lines. These charts give some conception of the accuracy of tooth form that is being obtained in the daily production of gears with modern hobbing equipment. Particular attention is directed to the fact that the deviation on these charts is plotted in units of ten-thousandths of an inch.

Fig. 4 is an illustration of modern hobbing machines shown cutting gears similar to those from which these charts have been prepared. In these machines, the number of gears between the cutter and the work table has been reduced to a minimum consistent with the adaptability of the machine for a wide range of work. Fig. 5 shows the main gear train of the machines illustrated in Fig. 4. The power is applied through suitable reduction gears to a horizontal splined shaft, which in turn serves as a common driver for both the hob spindle and the work table trains. From this common shaft, the power is transmitted through three pairs of gears to the hob spindle and through three other pairs to the work table.

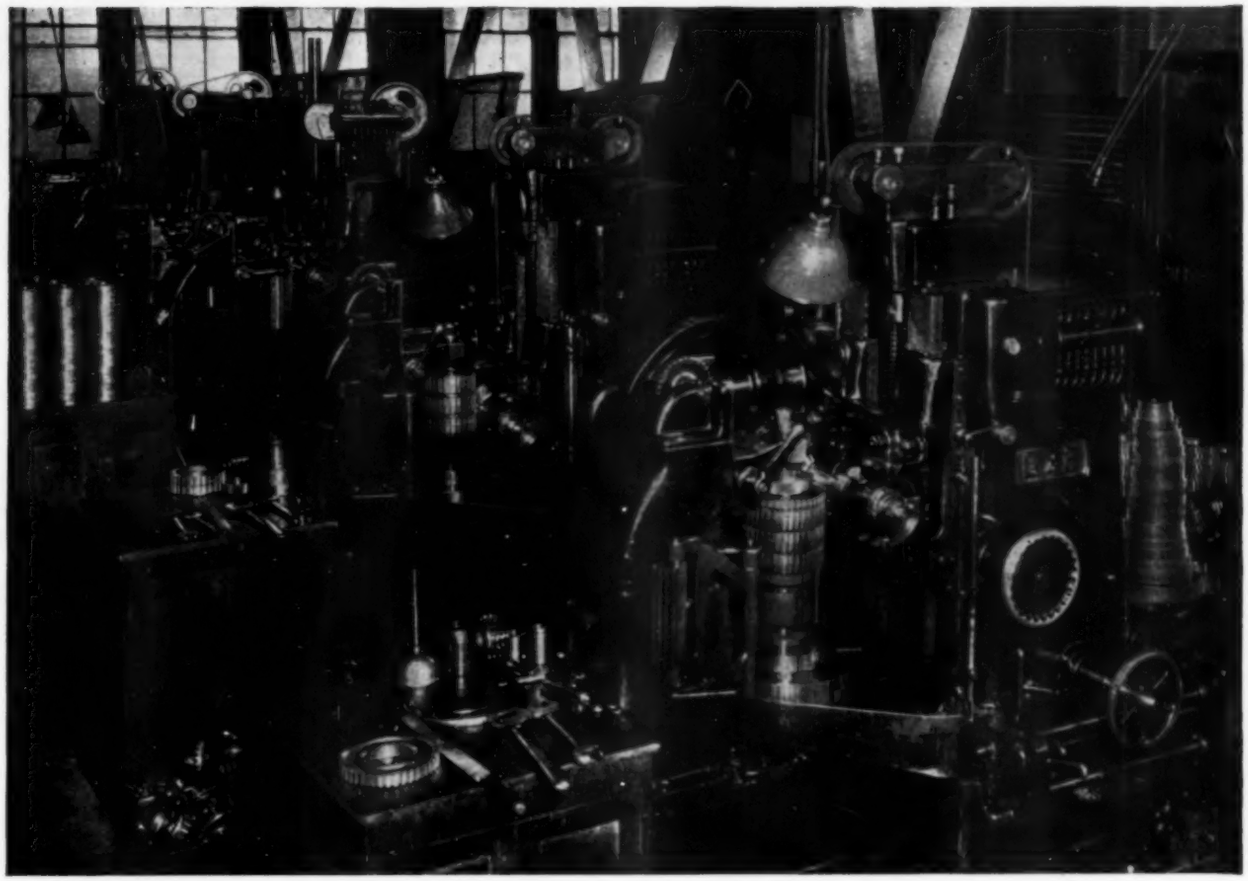


Fig. 4—Modern hobbing machines turn out their daily quota of accurate gears as a matter of routine

The final pair of gears in each train consists of a worm and wheel, the advantage being to obtain the steadying effects characteristic of this type of drive. This arrangement of gearing, termed a balanced drive, has been in use for a considerable number of years, and has demonstrated its efficacy in the production of accurate gears.

In the ideal machine, the relative rotation of the hob and the work table should be absolutely uniform. The slightest fluctuation causes appreciable errors in the teeth generated. For checking the finished machines, devices are in use which amplify the fluctuations and record them on polar charts. The upper chart in Fig. 6 was taken on a machine containing a defect somewhere in the main train of moving parts. By observing the frequency of the fluctuations, the cause may be located and rectified. Below it, is a similar chart from a machine in good condition. The particular device, utilized for making these charts, amplifies the fluctuations fifty times, which is twice the sensitivity of similar devices commercially available.

Fig. 7 shows the rugged construction of the cutter slide and work table, which is of vital importance for accurate work. It also illustrates the use of a large flywheel, correctly applied, which has proved beneficial. Another essential element in producing accurate gears is the maintenance of the accuracy originally built into the machine. This is accomplished by a proper choice of long-wearing materials, the provision of automatic lubrication, and adequate adjustment facilities. The sensitive and independent adjustments for the hob spindle and work table are particularly important. Both are provided with taper bushings for the diameter fit and separate adjustments for the end thrusts. In addition, provision is made for adjusting the worms and wheels, the cutter slide, and other essential parts. All of these are of fundamental importance if a hobber is to cut accurate gears not only when it is new, but over a long period of years.

The production of accurate gears is dependent upon a number of factors, one of which is the use of suitable machines maintained in correct adjustment. Other elements, equally important, are accurate hobs of the proper

Fig. 5—Simplification of the gear trains minimizes the possibility of error

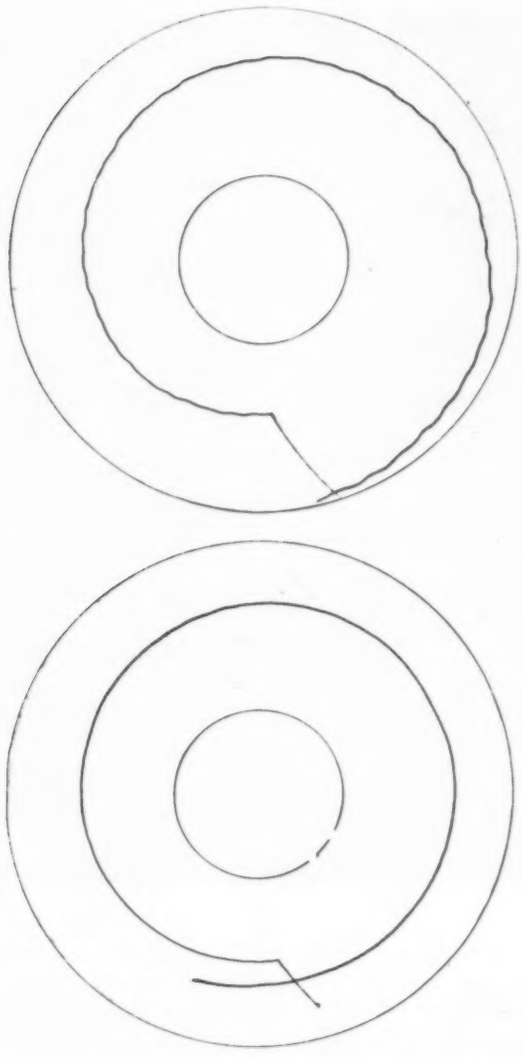


Fig. 6—Above is shown a velocity diagram for a machine containing a defective member in the main train. Below is a chart for a machine in good condition. Variations from the theoretically correct velocity are magnified fifty times

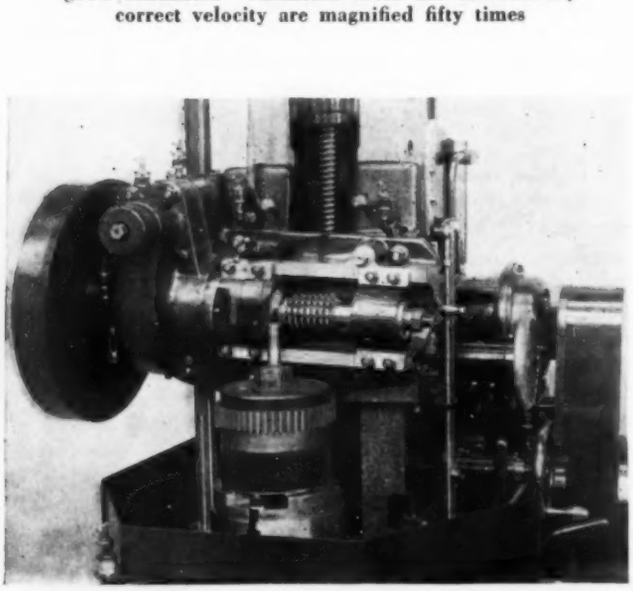


Fig. 7—Rugged construction and the correct application of a flywheel have also contributed to gear cutting precision

type, and adequate fixtures for supporting the blanks. The processing of blanks prior and subsequent to cutting the teeth is essential. The proper set-up and operation of the machine must not be neglected. It is the combined improvement in all of these factors that has enabled the hobbing process to become one of the most accurate and rapid means of cutting gear teeth.

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Good Machining Needs No Scraping
Discussion

A. HALLIWELL
Superintendent
General Iron Works Co.

REFERRING to the article on page 66, Vol. 74, there are wide differences of opinion as to whether or not scraping can be entirely eliminated. I have experienced difficulty in maintaining alignment after boring bearings in castings and finishing other machined surfaces. I found that the castings themselves warp due to internal strains and from handling. I also found a deflection of the boring bars due to offset cores and hard spots in the iron. This was overcome somewhat by taking several cuts. These little discrepancies, of course, result in the bearings either being out of line or having sufficient irregularity in their surfaces to make it impossible to seat half bearings in proper alignment; some scraping is necessary. I have tried three-point tools, two-point boring tools, solid shell boring tools, and single-point boring tools for roughing and finishing without accomplishing the desired result. I have used hardened bars and fixtures carrying hardened bushings and kept them in first class shape at all times, using bushings in the fixtures for piloting the bars, and using a flexible joint between the spindle and the bar in order to avoid the deflecting of the bars by the machine spindle—all without accomplishing the desired result. I have also used a diamond point in boring bars for finish boring; the bushings carrying these bars were in first class shape, but still we could not repeatedly bore bearings and get away from scraping entirely. With slow speed bearings, where the loads are not great, we might get by without scraping, but not where the loads are great and the speeds high.

I have gone so far as to season castings to try to eliminate scraping, yet this did not accomplish the desired result. I have rough planed machine tool parts, put them through the process of manufacture, and then finish-planed them only to find I had still to do a certain amount of scraping to make a first class job.

In boring bronze bearings I have found the difference in the density of the metal, particularly in cast bronze bushings sufficient to deflect a boring tool or a reamer enough to make scraping necessary for a proper bearing.

It is my opinion that to eliminate scraping entirely we should have perfect conditions in machining, and materials should be entirely free of all internal strains. The density of the material would have to be extremely uniform at all times. I am writing in the hope that others might become interested in the elimination of scraping.

ALTHOUGH nitrided steel is nobtaly rust-resistant, it must not be used to replace corrosion-resistant steels without careful tests for the particular purpose.

Abrupt Rise Cam Lobes

HAROLD P. BERRY

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Presenting a graphic method to avoid errors from cutter angularity when milling disk cams

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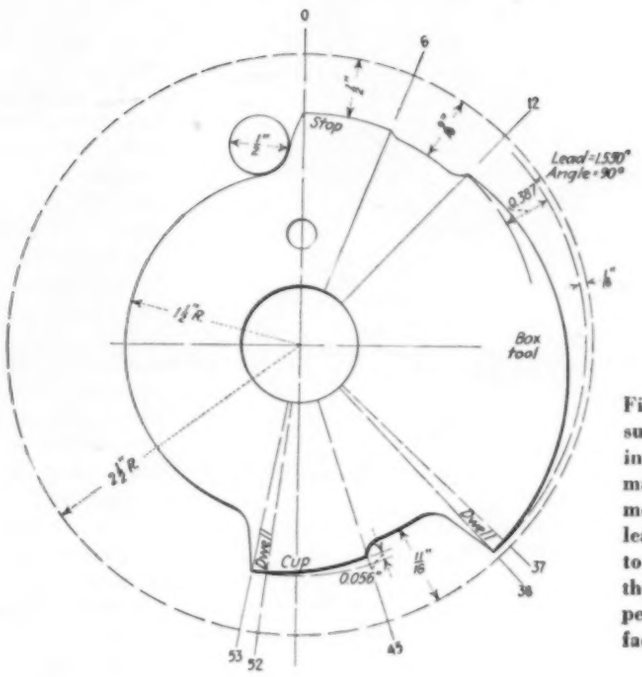


Fig. 1 — Disk cams such as this are used in automatic screw machines. The usual method of computing leads for milling is to divide the rise of the cam lobe by the percentage of cam surface occupied by the lobe

IN laying out the lobe of a disk cam, preparatory to machining, the periphery of the cam blank is divided into a number of equal parts. The milling of the desired rise is usually computed by considering the percentage of the entire periphery of the cam blank required for a particular lobe. For example, assume that during the functioning of a mechanism, a specific operation consumes one-fourth of the complete time cycle. If the time cycle is considered as 100 hundredths, the operation would consume 25 per cent or 25 hundredths.

A practical application of the principle is the use of disk cams in automatic screw machines, such as the Brown and Sharpe, which utilizes a cam like that shown in Fig. 1 for the operation of the turret tools. The method of machining the lobes of this cam, using a milling machine equipped with a vertical cutter head and a dividing table carrying the cam blank, has already been described. (*AM*—Vol. 34, page 55.)

However, in milling a cam lobe with an abrupt rise, this method will cause trouble in obtaining the correct lead. The radius of the milling cutter used will cause a discrepancy between the computed lead, for which the milling machine is set, and the resultant rise of the machined lobe. This error becomes more noticeable as the diameter of the cutter is increased. For all practical purposes, the error may be corrected by the graphic method of an accurate layout. Referring to Fig. 2, assume that a cam is to have a lobe with a rise *A* extending through 25 hundredths of the cam's periphery. To mill such a lobe, the machine is set for a lead, equal to the lobe rise $A \div 0.25$, by selecting suitable gearing.

With a pointed tool such as a scratchawl held stationary in the cutter head, completion of the operation will result in a scribed line on the cam blank. Upon examination of this line, it will be found that an exact duplicate of the computed lead has been produced. Suppose the scratchawl is replaced with a regular milling cutter and brought to position *B*, Fig. 2, on the 25 hundredth line so the cutting edge coincides with starting position as illustrated. If the cam blank is revolved in the machine through 25 hundredths of its periphery to position *C* on the 0 hundredth line, it will be found that the cutter has milled a lobe of *D* height instead of one of the desired height *A*. From this, it might be concluded offhand that the movement of the cam should be continued until the desired rise is produced, that is, until the cutter reaches point *y*. It may be seen, however, that in advancing the cutter to *y* the center of the cutter has been carried beyond the 0 hundredth line thereby actually using more than 25 hundredths of the cam's periphery to obtain a lobe of the desired height. This leads to the assumption that the machine should be set for a lead slightly less than the actual computed lead for the cam lobe. The question is how much less. To determine this quantity the layout method described will be found to be the quickest and will give excellent results for all practical purposes. Another method would be the use of higher mathematics to compute this amount theoretically.

For purposes of illustration, suppose a cam lobe extends from the 10 hundredths line to the 31¼ hundred line, Fig. 3. This leaves a total of 21¼ of the cam's periphery for the lobe. Taking the rise of the lobe as

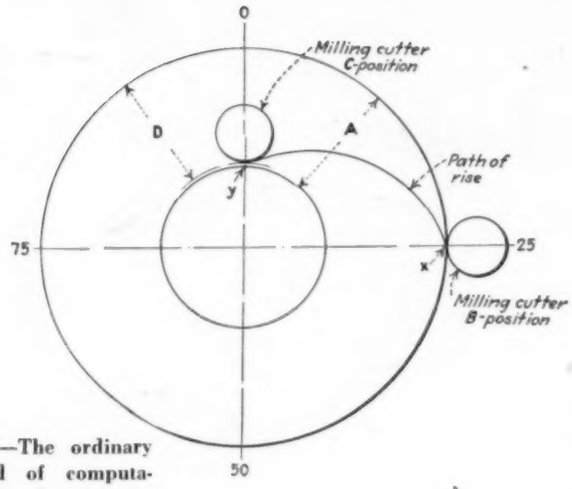


Fig. 2—The ordinary method of computation results in an error which varies with the diameter of the cutter used

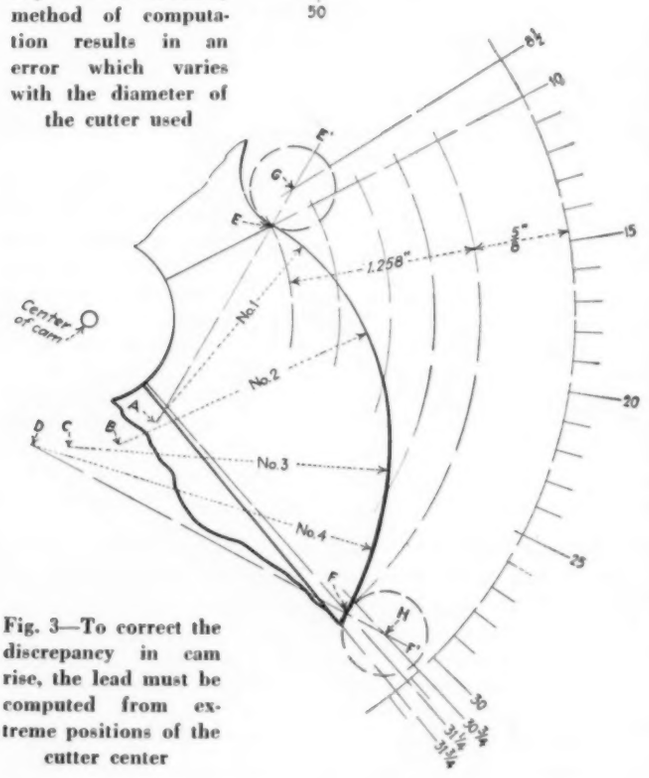


Fig. 3—To correct the discrepancy in cam rise, the lead must be computed from extreme positions of the cutter center

1.258 in., using ordinary computations the milling machine would be set up for a lead of 5.920 in. From the graphic layout of the spiral which represents the lead of the cam, it is found that the centers of the lobe extending from *E* to *F* are located respectively at *A*, *B*, *C*, and *D* for the radii Nos. 1, 2, 3, and 4. If a line is drawn from *A* through *E* and allowed to extend to *E'* and a line from *D* through *F* and allowed to extend to *F'*, these lines will represent perpendiculars to the point of tangency at the start and finish of the cam lobe. (See Fig. 3.) With a radius equal to the diameter of the cutter to be used in machining the lobe, with *E* and *F* as centers arcs are struck at *G* and *H* to represent the centers of the starting and finishing points of the cutters. From the center of the cam lines are drawn through points *G* and *H* and extended to the outside diameter of the cam blank. This gives the $30\frac{3}{4}$ and the $8\frac{1}{2}$ hundredth lines as the limiting points of the milling cutter to produce the desired cam lobe. Therefore in computing the lead of the machine, a total of $22\frac{1}{4}$ hundredths must be used. The resulting lead would then be 5.654.

A Square Deal for the Production Man

Discussion

C. R. AFTSMAN

THE recent editorial on this subject, page 334, Vol. 74, is very opportune. From the beginning of organized industry, production men have made very little progress in getting what may be called a square deal from some managements. Whenever production has presented its case such managements have charged those responsible for production with lack of co-operation.

My experience of nearly thirty years on production has convinced me that the average production man is a most alert, progressive, resourceful and co-operative member of modern industry. He has been, and still remains, the real leader of industrial progress. Investigation would show that a large number of the labor saving tools and appliances have been created in the shop by production men. Management should accept greater responsibility for the excessive overhead caused by obsolete equipment and some of the mysterious accounting methods which are such a burden that many industries are dangerously close to bankruptcy. I fully agree with the statement in the editorial that production men may have to study accounting in self defense. The following experience supports this conclusion.

During a consolidation of several productive departments the writer found that a small power press section had been charged to overhead expenses over a period of several years instead of being charged to direct labor expense. When the situation was called to the attention of the accounting department it promised that the labor hours henceforth would be charged to direct labor expense. Later on, when the weekly cost comparison sheets appeared, a check of the various jobs showed that the change was a boomerang against the production department due to the fact that on jobs where there were no standard costs the work would be charged as a loss against the department.

The following list was taken from one of these cost sheets:

Job No.	Labor Cost—Actual	Labor Cost—Standard	Gain	Loss
472	0.63	(none)	...	0.63
503	.94	0.94	...	...
457	.32	(none)	...	.32
500	3.44	(none)	...	3.44
297	2.76	2.86	0.10	...
710	4.09	4.09	...	...
507	2.29	1.80	...	.49
503	2.82	(none)	...	2.82
302	.32	(none)	...	.32
389	.90	1.08	.18	...

It is evident from the list that the only way for the production man to beat the system would be to stop all production, because on those jobs where no standard cost was given, any labor at all was counted as loss against the department. Such cost accounting prevents any true yearly summary of comparative labor costs.

Real management should strive to inject common sense into its accounting methods, to abandon obsolete equipment, to standardize its orders as much as possible, and to reduce unnecessary overhead materially. The production man has done his part. Let management give him credit.

■

A certain aviation motor has been built with nitrided cylinders. After 100 hours flying it shows no wear.

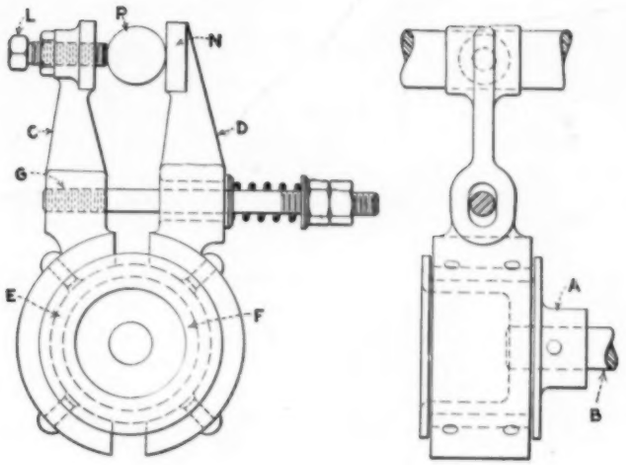


Fig. 1—Assembly of the brake mechanism when finished

Machining a Small Friction Brake and Drum

FRANK H. MAYOH
Designing Engineer, Package Machinery Co.

A PROBLEM often presented in machine construction is one requiring that a section of the machine comprising an intermittent motion be stopped. This will frequently necessitate the use of a friction brake acting as a drag without sufficient tension to retard the normal running of the unit when it is being positively driven.

In the drawing, Fig. 1, a brake for this purpose is shown. A drum *A* is mounted on the end of the revolvable shaft *B*. This shaft is part of the operative unit in the machine which has to be stopped, and the drum is pinned thereto. The braking member consists of two arms *C* and *D*, and each of these arms is lined, where it contacts the drum, with leather or other friction material as indicated at *E* and *F*. This friction material is held in place by rivets, preferably of the split countersunk type, although plain rivets are indicated in the drawing. There is a long screw *G* threaded into one arm of the brake. This passes through an elongated hole in the other arm. There is also a spring which is tightened by means of check nuts so that the proper tension is exerted by the spring to give the desired amount of friction on the brake drum while it revolves. There is, in addition, a screw *L* that clamps the end *N* against a stationary rod *P*. The entire brake unit is suspended in a floating manner, therefore the brake lining adapts itself to a running contact with the brake drum.

Referring to Fig. 2 it is seen that both arms of the brake are cast together and are partially machined as one unit. This unit is indicated at *A*, and a three-jawed chuck grips the work by the hub in the manner shown, two counterweights being used for the purpose of providing a running balance for the work. The operations of boring and facing are performed in a turret lathe using combination tools.

The first operation consists of rough boring the hole and rough facing the end of the work. This is done by means of the holder shown at *E*, which is mounted in the turret and carries a flat cutter *F*, held in place by a tapered key. A tongue at *H*, coacting with flats on the bar, centers the cutter. A cutter *J*, having serrations in its face, is clamped in place by screws and backed up by an adjusting screw. This tool rough faces the end of the work, while a pilot guides the boring holder in a bushing held in the spindle of the machine. A somewhat similar holder *P* holds a single point cutter for finish boring the hole in the work, while a facing cutter *R* finish faces it. A shell reamer, held by a floating holder is employed to ream the hole in the brake arms. The reamer is held in the third hole of the lathe turret.

There is still another operation that requires revolving of the work. It consists of facing the end and sides of the brake arms. To do this an arrangement of tools is used as shown in Fig. 3. The operation consists of feeding in the lathe cross-slide while cutter *B* rough faces the work. To finish face the same end, a cutter, held in the rear cross-slide block, is fed toward the front of the lathe. The work is held on a split expanding arbor held in the spindle of the machine. The working end of the arbor is centered, and the work is driven by a stud in the face plate.

A feature that will have been noticed in connection with this combined brake arm structure is that there are two slots *R* and *S* cast in the periphery of the hub. The work is cut into sections after machining, and the object of the grooves is to reduce the amount of metal to be removed to a comparatively small portion. This operation of cutting apart is performed in a broaching machine, using two broaches. The work is placed over the hub portion of the guide bushing and is located radially between two pins and held by a clamp.

The holes used for securing the brake lining are drilled in pairs 90 deg. apart. A combination tumble jig for doing this is shown in Fig. 4. For drilling two of the holes the jig is resting on surface *B* and the drilling is

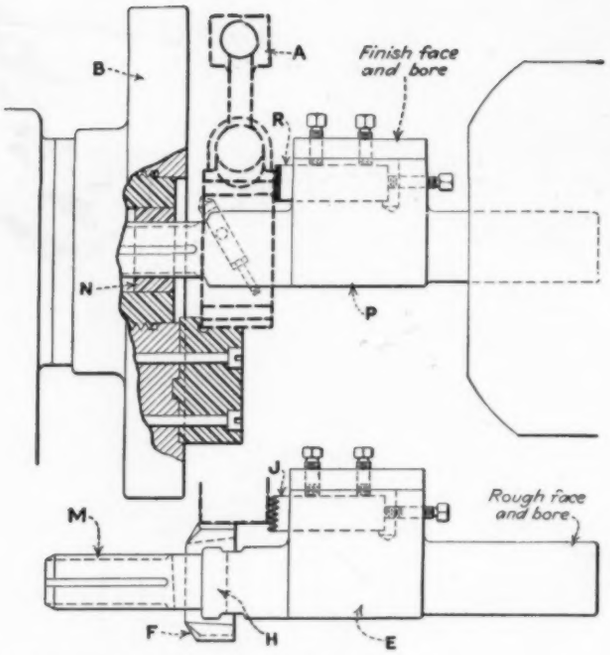


Fig. 2—First operation in turret lathe using the tools shown

done through guide bushings *A*. For drilling the other two holes through bushings *C* the jig is resting on surface *D*. The work is registered from the half-circular steel block *F*, being located radially on the finished surfaces *H* and *J*. It is also pushed back against the lug *K* and clamped by the set screw *L*.

This completes the machining on one half of the brake arms. On the other half, it is necessary to drill the two screw holes, one for the spring stud and one for the clamp screw. This is done in the jig shown in Fig. 5. Registering, as before, is done from a half-circular block.

Only one handling of the brake drum is necessary as all the machining is performed with the combination of tools shown in Fig. 6. The part is gripped in a three-jaw chuck, using jaws machined so that they back up the work endwise and have clearance to permit the tool that turns the outside diameter to travel clear across the periphery. They are also cut away at *C* to provide clearance for a back-facing cutter *D* which machines the hub face. The back-facing cutter is attached to a draw-back rod *F* through the spindle of the machine. The spindle of the turret lathe is indicated at *G*. Through this spindle is longitudinally operated a bar *H* which is held stationary against rotation, thereby performing the back-facing operation as the work revolves.

In number one turret face is mounted a drill holder of the type indicated at *J* in the central view. This holds a short drill that spot faces the work. At the same time a block mounted on the rear of the cross-slide, with cutters grouped as shown in the upper right hand corner in block *K*, rough faces the groove in the work, using a serrated cutter *X*. Another cutter *X* faces the end of the work. To the next turret face is attached the combination of tools shown in operation on the work. A drill *N* (shown partially broken off) completes the drilling of the hole, a cutter *P* attached to a bar *Q* turns the outside diameter of the work, the hole being held in a holder *R* mounted on the cutter. Cutter *S* finish grooves the work, while cutter *T* finish faces it. These cutters are held in a cross-slide block *U*, which has clamping screws for holding and adjusting screws for backing-up the cutters. The front cross-slide block and the rear cross-slide block, used for roughing, are essentially the same in design although of different heights. A cutter *V* in drill holder *W* bores the inside of the drum portion of the work, and a flat cutter *X* attached to the boring bar *J* finish bores the small hole in the brake drum when the third face of the turret lathe is indexed into position. In boring bar *J* is a cutter *Z;* this is used for rounding the corner of the brake drum at the large opening. Reamer *I* mounted in

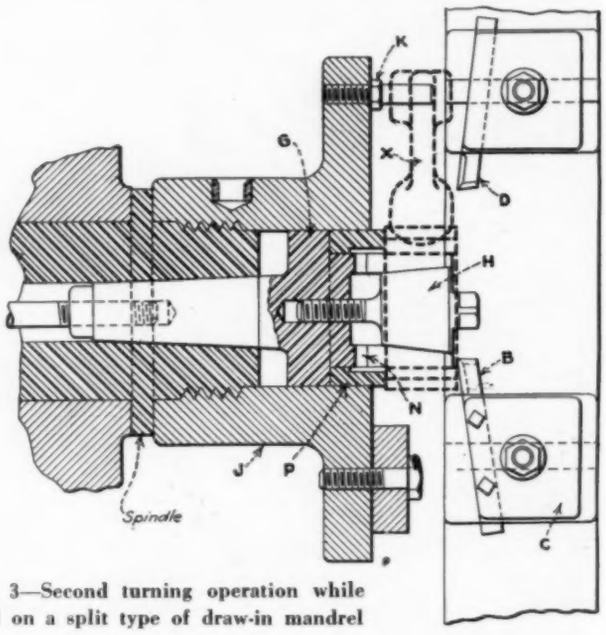


Fig. 3—Second turning operation while held on a split type of draw-in mandrel

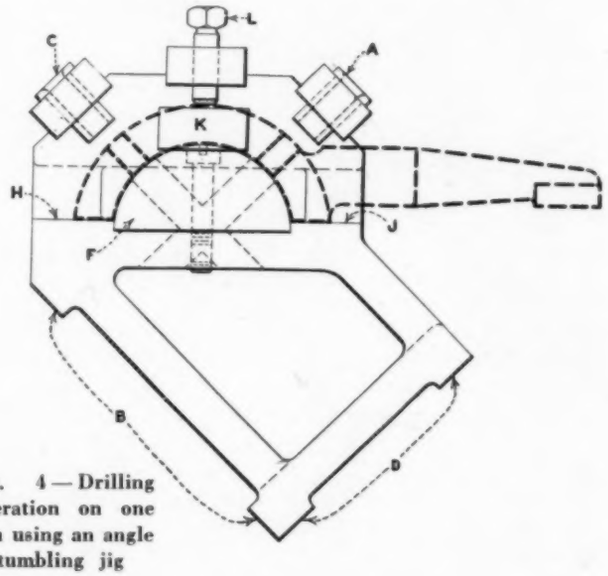


Fig. 4—Drilling operation on one arm using an angle tumbling jig

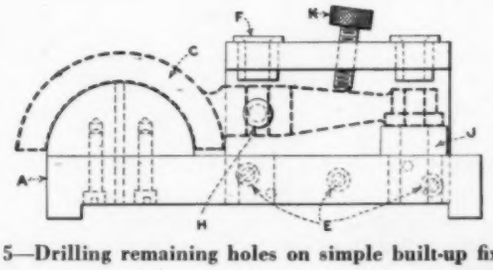


Fig. 5—Drilling remaining holes on simple built-up fixture

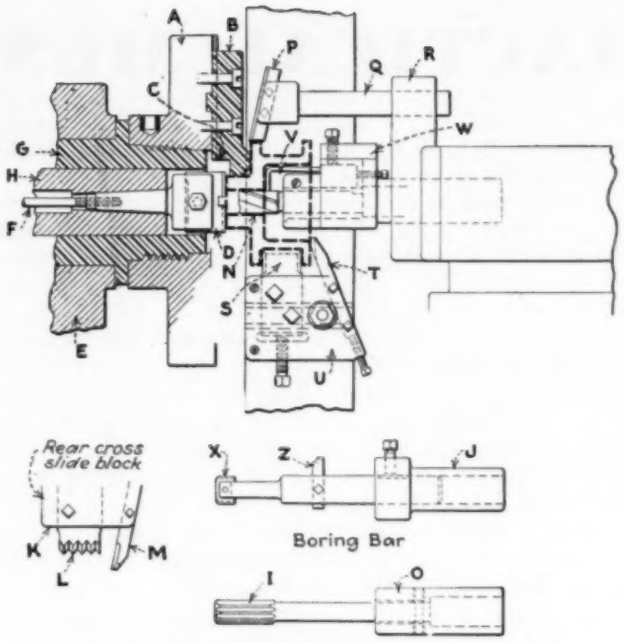


Fig. 6—Machining the drum in one operation, using a back facing tool through the spindle

a floating holder *O* is attached to the fourth turret face for reaming the shaft hole.

The combination of tools shown working on this brake drum is arranged to overlap and perform the cutting operations in a minimum of time, and the only surfaces left rough are the hub and the face of the drum adjacent thereto. These, however, run reasonably true as the chucking is done from them. Units such as this brake are in reality important features of machines intended to develop a high degree of operating efficiency, and it is possible to standardize on the design of this or similar items so that different machines of the same general nature will use the same unit, thereby making it economical to use tools to machine them.

■

Shaft Repair In Place

T. E. JARNIGAN

OUR PLANT fabricated corrugated ends for freight cars and was, at the time, running a special type which had the bottom flange bent back on the same side as the corrugations. The bend was too close to the last corrugation to permit flanging in the regular hydraulic press, hence a special press operation was required. We had dug up an ancient V-die which fitted a 10-ft. shear and set up the job on this machine. The male die, V-pointed, was only about 1½ in. thick, hence cleared the edge of the corrugation. We found that sheets could be run under the die, flanged with one stroke, caught by the operators as the bending tipped them, and then slid out of the end of the press onto a pile. The set-up had been running successfully for several days, bending the ¼-in. sheet exactly to specification.

Suddenly there was a crash, a tremor that shook the building, and the strangled roar that means a jammed press. The pressman had allowed his foot to linger just a moment too long on the treadle. The clutch had stayed in, and a plate had its just-finished flange jammed against the male die holder, stopping the press dead and jamming the clutch. The driving gear, about 5 ft. in diameter and mounted on the eccentric shaft, stood at a crazy angle, half clear of the driving pinion.

It was a simple matter to remove the gears, but the clutch was a different matter. The shaft was bent just at the outer bearing, and that, combined with the twisted keyway in which the clutch key fitted, held the clutch tightly. (The shaft was approximately 8 in. in diameter where it passed through the clutch, the clutch being about 2 ft. in diameter and 20 in. long, of the conventional toggle type). We finally succeeded in forcing the clutch off and found the shaft sprung about ⅝ in. out of line, and also twisted about ¼ in. in the approximate 30 in. it extended from the housing. The twist could be taken care of easily by widening the keyway and inserting a larger key, but the shaft looked like a hydraulic press job.

But then we learned something else about straight-line production. In laying out the line, the big press had been put within 3 ft. of a twin, with the resulting necessity of moving one of the presses before we could draw the shaft. Either press weighed somewhere between 25 and 30 tons, and was bolted and grouted securely to its foundation. Even if we might have drawn the shaft, we had no tools around the shop to hold the job successfully. It was finally decided to straighten the shaft without removing it from the press. Much jacking and prying, with the assistance of the overhead crane, got the plate from under the ram and permitted us to turn the shaft over so that the bent end was downward. We then set a 100-ton hydraulic jack under the end. Heating the shaft was necessary to assist in straightening, and the heat would cause little difficulty in the bearing because the heavy cast-iron housing would absorb the heat too rapidly to permit injury. The only means of heating were oxy-acetylene torches. We tried them all one day and half the next, with alternate heating and jacking, but with a conspicuous lack of success. The torches were capable of getting the shaft red hot in spots, but could not supply heat fast enough to get a red heat at the core. Any effort at jacking simply lifted both press and foundation as a unit.

We finally thought of the crude oil "blowtorches," throwing a 30-in. flame, 6 in. in diameter, used for tank work, and dug two of them up. They were set on opposite sides of the shaft, and their flames soon accomplished the heating job. As soon as they were out of the way, slight jack pressure was put on while a copper bar over the heel of the bend was tapped with a sledge. Finally, the shaft bent, but went past center and into a kink on the opposite side. Two days' work for nothing!

There was nothing to do but allow the shaft to cool. The whole wearisome process had to be repeated. This time we sledged harder and used less jack pressure, with the result that the square showed the shaft less than a sixty-fourth inch out. In that position it was allowed to cool, with the result that our shaft was almost perfectly straight. Then the keyway was filed wider, a key made to fit and the clutch reassembled. The next morning dawned with a press ready to go and carrying a spring kickout so that our pressman friend could sit down on the treadle and still get only one stroke, no more, no less. Our impromptu repair, even though it was unorthodox, was successful, for the machine has been running six years now with no further trouble.

IDEAS FROM PRACTICAL MEN

Quintuple Piercing Tools for an Architectural Shape

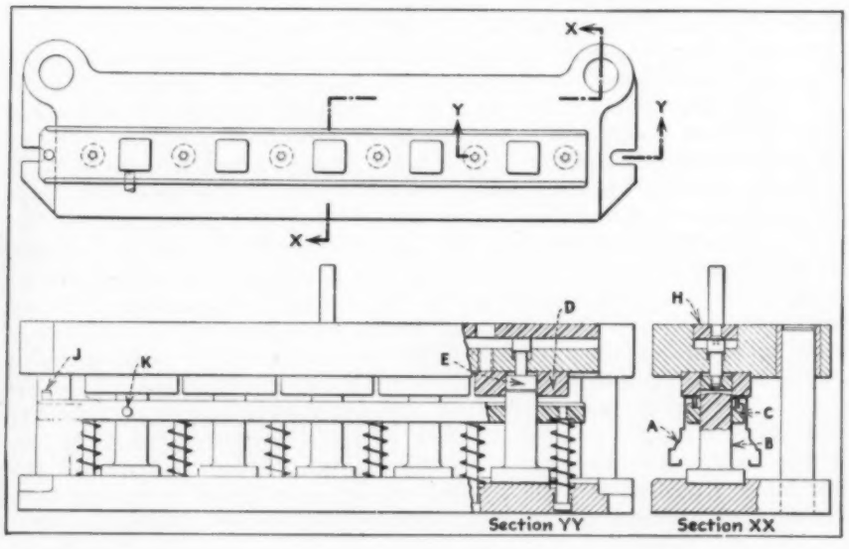
EDWARD HELLER

THE illustration shows tools for punching five holes at a time in the bottom of the molded channel *A*. This channel, which is quite long, has holes punched its entire length at 5-in. intervals. The number five was selected because that number of holes was all that the longest die that could be gotten into the press would accommodate. Any less number of holes to be punched at a time would have made the time of the operation too long.

Due to the peculiar shape of the job, the piercing operation offered a few interesting problems in die design and making. The nature of the job, of course, is such that the punching cannot be done in the accepted direction, but must be done upside down. The punches *B* are mounted in a die shoe. The continuous stripper *C*, held in place by safety screws and actuated by six springs, is fitted closely over the punches and is shaped to fit the two projecting ribs of the work, so as to act as a sidewise locator.

The piercing dies *D*, on the other hand, are attached to the punch-holder. To take care of the slugs, each die carries a positive knockout at *E*, and held up by a safety screw. The five knockouts are operated by the bar *H*, which lies loosely in a groove in the top of the punch-holder. This bar has a heavy stud riveted in the middle to make contact with the positive knockout in the ram of the press. Because of the groove in the punch-holder, it is not convenient to have a shank on its top without making the die exceedingly high. The dies, therefore, are held up to the ram by two screws that go through clearance holes in the knockout bar and screw into tapped holes in the punch-holder. These screws serve the double purpose of holding the die to the ram, and keeping the knockout bar from sliding sidewise.

The stripper is continued for a short distance to the left, to provide a place for the pin gage *J*, against which the edge of the last hole punched is held. In addition, the removable gage pin *K* is put in the side of the stripper to gage the first "hit," as the job is laid out so that there is only a half hole at each end. The channels are made in lengths of from about 60 to 125 in., varying in steps of five inches. They are of 18 gage (0.043 in.). The longer lengths offered an additional problem of supporting the ends, caused by the moving of the entire job up and down during the operation of the press. Therefore, it was necessary to provide stands, or horses, in which the upper parts floated on springs. After springs of the proper tension were selected, the job went on satisfactorily for many days at a time.



Grinding in the Lathe

O. D. BRADSHAW
St. Johns, New Brunswick, Canada

A quantity of short pieces of hardened drill rod were to be ground to the same length within a limit of 0.004 in. Not having a grinding machine, the work was done in a lathe fitted with draw-in collets. A small electric center grinder was held in the toolpost. The wheel was trued and the grinder was set so that the spindle was at the height of the lathe centers. Setting the face of the wheel at a slight angle to reduce the grinding surface, a piece was put into the collet and the end was ground by traversing the grinder by means of the cross-feed screw. The lathe was run at 250 r.p.m. and all the pieces were ground on one end in this manner.

For grinding the opposite ends, a small hole was drilled in the collet, in which a pin was driven to act as a stop for the finished ends of the pieces. The compound rest was swung at an angle so that a fine adjustment could be made by means of its feed screw, both for length of the pieces and for wear of the wheel, the carriage being locked in position. An adjustable stop on the compound rest completed the arrangement. After all the pieces had been ground on one end, they were again run through the machine to finish the opposite end.

With one of the pieces in the collet with its finished end against the stop pin, it was ground to length by trial and error. When the piece was the correct length, the adjustable stop was set so that the wheel could not be fed in any farther. For grinding the rest of the pieces, it was necessary only to place them in the collet against the stop pin and pass the wheel across their ends as many times as was necessary to remove the surplus

stock, feeding the wheel in at each pass. When the wheel had been fed in as far as the stop on the compound rest would permit, the pieces were of the correct length. Each piece was carefully checked after grinding, and any necessary adjustment was made for wheel wear.

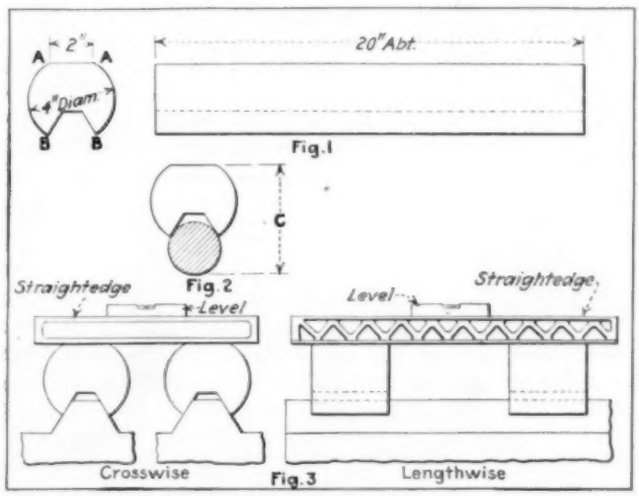
■

Truing-up Long Lathes

R. M. SHERMAN
Newport News Shipbuilding and Dry Dock Company

The following question was received from another company: We have two lathes, 30-in. swing and 45 ft. long. These lathes are on a concrete floor and are grouted in. We want to true them up and take all the twists and winds out of the beds. We don't just know the best way to go about this. Can you help us? We would like to get the beds true within 0.001 in. both ways, if such a thing is within reason.

Answer: The directions in which the lathe bed is out is not clearly stated, but the fact that it is desired to get it true "both ways" indicates that it has probably dropped at the joint between the two sections, and that the front or rear way has dropped. This is the usual condition. Grouting, where the grout is carried up over the bottom flange is no longer considered good practice, but whether it is removed or not depends upon the nature of the out-of-true condition. Short kinks and worn spots



cannot be remedied by packing. The first thing is to go over the Vees carefully and draw-file and stone them smooth. This does not mean attempting to remove scoring or scratches, but any burrs or high spots that may protrude above the surface.

In the meantime a steel mandrel about 4 in. in diameter by about 20 in. long should be turned and ground parallel to 0.001 in. along its length. The size does not make any material difference, but parallelism does. Next, plane or shape a 2-in. flat *A–A*, Fig. 1, on one side. This surface is for applying a precision level, and it must also be parallel with the round part of the mandrel. To obtain this, place the mandrel in Vee blocks and grind it on a surface grinder. To check, reverse the part and see if the wheel touches at both ends.

After checking, plane or shape the Vee *B–B*. The angles of the Vee should be identical with the Vee on the lathe bed. Its depth should be such that about $\frac{1}{4}$ in. clearance will remain between the top of the lathe Vee and the gage. The gage should extend at least half way down the lathe Vee, and be slightly relieved at the lower edges.

To test the accuracy of the Vee block, apply a thin coat of red lead to a lathe Vee where it is least worn and scrape the Vee block to fit it.

After fitting, cut the Vee-block into four equal lengths and check each part to some convenient mandrel, as shown in Fig. 2. The dimension *C* should be checked at both ends with a micrometer. The suggested method of making the Vee block has been such as to minimize any error. If the error in parallelity from end to end should be 0.001 in. the cutting into four lengths would reduce it to 0.00025 in. in each length. If the round mandrel *D* is parallel, the Vees should show very accurate on this test. If not, turn the two parts end for end and see which end is out. All eight ends of the Vee blocks should be alike. The results secured in leveling will depend upon this accuracy.

With an accurate straight edge it remains but to start at the headstock and check at various points along the bed both lengthwise and crosswise, as Fig. 3 outlines.

The method outlined above assumes that the lathe bed needs only leveling, that the tailstock center has not been changed in height, nor thrown out of line sidewise. The man who runs the lathe knows its peculiarities, and if he finds himself turning different diameters with the same tool setting, or taper, he will know that other remedies than leveling are required.

In that case, use the Vee blocks and a wooden pin gage for testing for side variation of the tailstock spindle, and the Vee blocks and the straight-edge for vertical gaging.

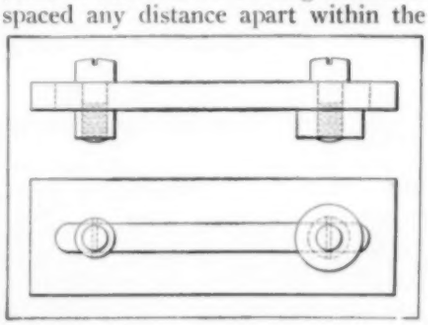
■

A Universal Protractor for Tapers
Discussion

JOSEPH E. ABBAZIA
Mechanical Instructor, Apprentice School
Yale & Towne Manufacturing Company

While the device described by G. H. Felske, in an article under the title given above, *AM*—Vol. 74, page 513, is good for duplicating the tapers of work to which it has been set, it cannot be depended upon for accurately measuring the angle unless a test bar is used, because protractors do not usually read closer than degrees unless equipped with a vernier.

The test bar shown in the illustration consists of a plate having a slot nearly its entire length; two disks of different diameters; and two screws for locking the disks. The disks can be spaced any distance apart within the length of the slot.



If the protractor has been set to the work and the angle is to be found, the test bar is applied to the protractor and the disks are set so that they touch the

edges of the blades. Knowing the diameters of the disks, and finding their center distance by micrometer or vernier, the angle can be found by trigonometry. Conversely, if the protractor is to be set accurately to a predetermined angle, the proper setting of the disks can also be found by the same means. The test bar is then applied to the protractor and the edges of the blades are brought into contact with the disks.

While the distance between the disks must be such as to bring them within range of the protractor blades, the farther apart they are, the greater will be the accuracy obtained.

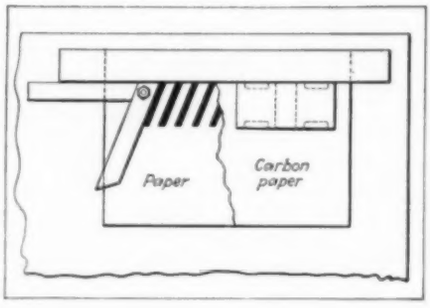
■

Checking the Angles of Helical Gear Teeth
Discussion

IRA S. WILLIAMS
Western Electric Company, Baltimore Plant

In an article under the title given above, *AM*—Vol. 74, page 553, George Belbes describes a method of checking helix angles. A much simpler method is shown in the illustration herewith. While it is not as accurate as the method described by Mr. Belbes, if care be taken it is accurate enough for most cases.

A piece of paper is first laid on the surface plate and upon it is placed a piece of carbon paper, the whole being confined by a hardened and ground parallel clamped on top. The gear to be checked is placed against the parallel and is rolled along its side and over the carbon paper, after which the carbon paper is torn off close to the edge of the parallel. The marks of the teeth will now be found on the paper. A protractor applied to one edge of the parallel will show the helix angle of the teeth. While the angle obtained is the angle at the outer diameter of the gear, the lead and the angle at the pitch line can easily be computed.



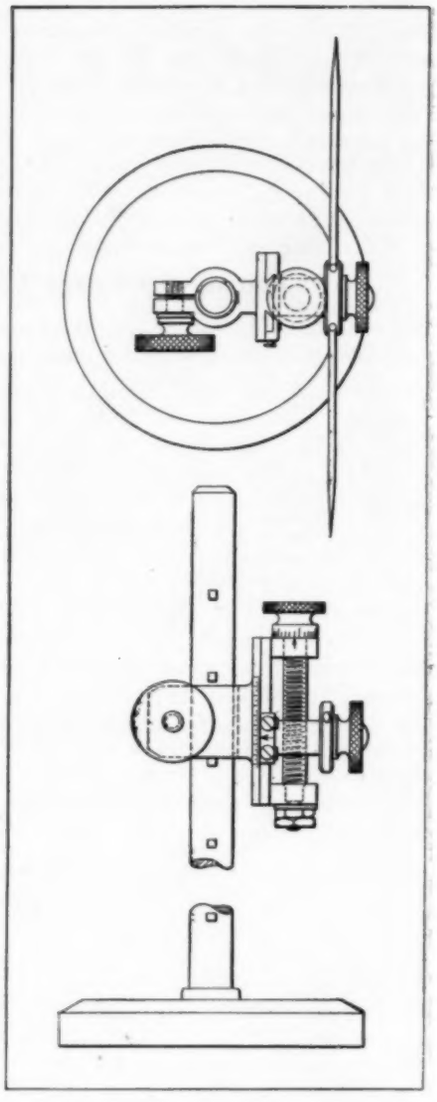
A way to get the helix angle at the pitch line without calculation is to turn a blank, the outer diameter of which is the same as the pitch diameter of the gear to be checked, and to cut the teeth to the dedendum depth. If the gear is rolled over the carbon paper, the helix angle at the pitch line can be found by using the protractor, as in the previous method.

■

A Micrometer Surface Gage

D. Q. DUNSTONE
Hetton-le-Hole, England

A surface gage of rather novel design is shown in the accompanying illustration. The scriber holder is moved along a V-slide by a micrometer screw having 40 threads per in., the head of which is graduated in 25 divisions. By this means the scriber holder can be adjusted in increments as small as 0.001 in. Divisions of height in whole inches are provided for by a series of square - headed plugs let into the upright and projecting from its surface.



The base upon which the scriber holder slides, rests on the top of one of these plugs. A keyway is cut in the hole of the base, so that by rotating the base 90 deg. to the left it can be moved up or down the upright without interference from the plugs. No radial movement of the scriber can occur without its being loosened in the holder, so that actual heights, or differences in heights can be obtained from the reading of the gage.

When working from a center line, the gage should be set to the nearest inch, the base upon which the scriber holder slides resting on top of one of the plugs, and the micrometer reading zero, or 0.5 in., as the user may prefer. The scriber can then be adjusted to the center line. Lines parallel to the center line, and at any variation from it (within the limits of the gage) may be accurately scribed without the use of any other measuring instrument.

■

Boring Bar With an Adjustable Cutter
Discussion

DONALD RAEBURN
Glasgow, Scotland

In an article under the title given above, *AM*—Vol. 74, page 217, of the *American Machinist*, Charles C. Tomney describes his troubles in reaming shouldered holes and tells how they were overcome. While the method adopted is quite good, I do not think that Mr. Tomney realized the real cause of his trouble. The trouble was not caused by faulty indexing, but by excessive wear of the turret slide, and should have been corrected. The

wear of the slide caused trouble with the reamer, which was probably aggravated by the castings not uniform in hardness.

The placing of the cutter at a right angle to the plane of indexing indicates clearly where the trouble lies, as the thrust of the cut is thrown upon the sides of the slide and balances the side play during the progress of the tool. With a single-point cutter set parallel with the plane of indexing, there being side play in the slide, the bore *A* in Mr. Tomney's illustration would be tapered, the amount of taper being dependent upon the amount of looseness in the slide.

Had Mr. Tomney used a double-end cutter, accurately ground and neatly fitted to the boring bar, and placed parallel with the plane of indexing, with the cutter so held as to permit sidewise floating, the errors of indexing and the wear of the slide would have given very little trouble.

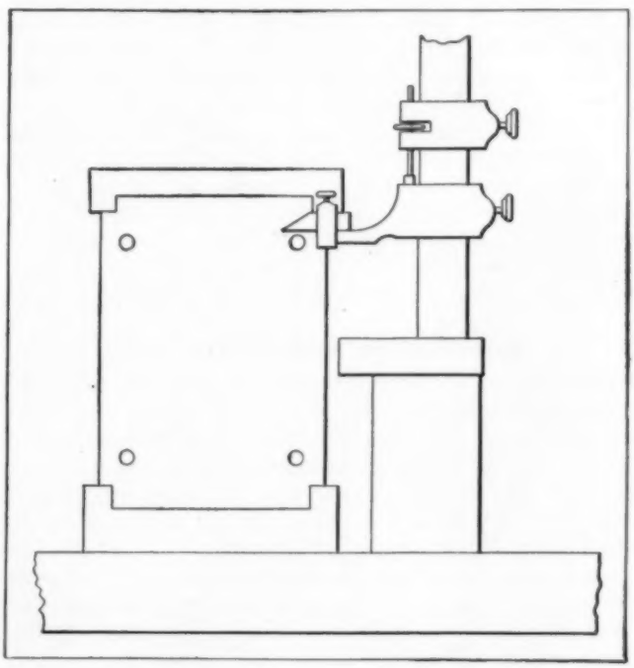
■

Checking Bushing Holes in Jigs *Discussion*

ARTHUR SILVESTER
Manager, The Iten Fibre Company

In a short article under the title given above, Vol. 74, page 64, of the *American Machinist*, Charles Kugler describes a method of converting a vernier caliper into a height gage. On page 479, George Belbes criticizes Mr. Kugler's method of clamping the vernier caliper to an angle plate, and suggests making a base for it, which he says will make for greater accuracy.

I do not believe that real accuracy can be obtained by Mr. Kugler's method, even should he use Mr. Belbes' base to hold the vernier caliper, and it is questionable if any chief inspector would permit a jig so checked to pass into the production department. My reasons for taking this stand are that the height has to be taken by the use of an indicator that is not of the type intended for service in connection with a height gage. Furthermore, in order to guarantee correctness and to transfer the height so obtained, the inspector can not get the final figures until after he has made allowances for the height of the stationary jaw and the difference between the inner and outer measuring surfaces of the movable jaw (*A* and *B* in Mr. Kugler's illustration). Also there are not many superintendents who would permit an inspector to clamp a vernier caliper in the manner suggested.



A simple method of making the required measurements by a height gage that is too short, is to measure the height of the lower holes in the bushing plate directly from the surface plate. For measuring the height of the upper holes, the height gage can be stood on a block of known height, as shown in the illustration. To the reading of the gage must be added the height of the block on which it is stood, and the height of the lower holes from the surface plate must be subtracted from the corrected reading to get the distance between the two holes.

Standard test plugs should be placed in all the holes and the measurements should be taken from their tops. If the lower and the upper holes are of the same diameter, no further correction of the reading is necessary. If the holes are of different diameters, a correction must be made accordingly.

■

Boring in the Milling Machine *Discussion*

DANIEL I. KRAUSS

In an article under the title given above, on page 22, Vol. 74, of the *American Machinist*, Charles Kugler describes a method of setting a single-point tool in a boring bar not having a micro adjustment.

May I suggest that if Mr. Kugler finds his method satisfactory, he might obtain more accurate results if instead of moving the table for bringing the cutter into contact with the side of the rough-bored hole, and afterward bringing the work back to its former location, he will move the knee up or down and contact the cutter with the top or bottom wall of the hole. If the center distance of the hole is in some accurate relation to another part of the work, horizontally, I have always found that in locking the table after it has been reset, the center distance is out 0.0005 in. or more, no matter how carefully the stops have been set. Moving the table is all right if the center distance of the hole is in a vertical direction in relation to some other part of the work.

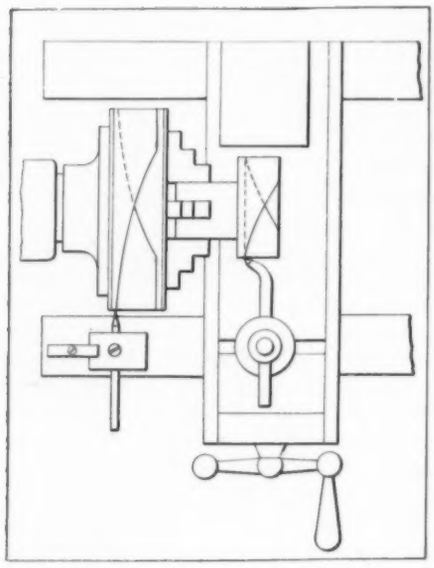
■

An Improvised Method of Making Helical Cams—*Discussion*

CHARLES KUGLER

The article by George Wilson under the title given above, on page 365, Vol. 74, of the *American Machinist*, interested me because I have made cams of the same kind, but by a slightly different method. Instead of laying out the outlines on the cams themselves, I laid them out on a strip of paper long enough to go around the body of the lathe chuck.

With the layout glued to the chuck, and a scriber



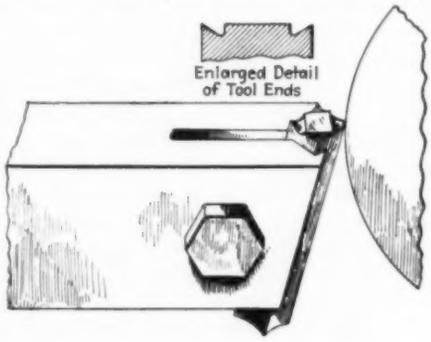
attached to a block on the wing of the lathe carriage, as shown in the illustration, the cams were nibbled in the manner described by Mr. Wilson. The scriber was at all times kept on the layout lines by moving the carriage. The chuck was, of course, intermittently rotated by hand as the nibbling proceeded. Since the layout on the paper is much larger than the cams, any inaccuracy in the layout will be reduced in the cams. The lines on the paper layout can be followed more easily and more accurately than can lines on the cams themselves, so that when the nibbling has been completed, very little filing will be necessary.

■

Lathe Tool With Eight Cutting Edges

I. B. Rich

Long life cutting tools have a real appeal in most shops. Here is a lathe tool that has several good points, eight of them in this case. The job is turning the rims of small cast-iron flywheels with round rims. The tool is a piece of square Stellite held in a split-end toolholder as illustrated. The ends are ground with four cutting corners, the top rake of the cutting corner being secured by grinding across the corners just behind the cutting edge. With both ends of the square bar ground in this way, the operator has eight cutting edges ready for use before regrinding is necessary. The tool cost is low and the results are very satisfactory.



■

Classification of Welding Processes—*Erratum*

In the Reference Book Sheet under the above title (*AM*—pp. 695. Vol. 74) Mr. Llewellyn's paper was credited to the A.S.T.M. It was, however, first prepared for the Recommended Practice Committee of the A.S.S.T., which published the information orginally.

SEEN AND HEARD

●

Hand Work Still Exists

THOSE of us who visit large automobile plants and other shops where mass production prevails are apt to think that hand methods are out of the picture at present. But the minute we leave the large manufacturing centers we find more hand work than we felt existed in these modern days. Although small electric motors have made their way into even remote sections, there are still large numbers of holes drilled by hand; old-time craftsmanship still has plenty of chance for exercise. The man whose nature rebels at repetition and who objects to being a number on the payroll can still find opportunities for his talent if he will pay the price of comparative isolation. It is also likely that his pay envelope will be less bulky and he may decide to stay where he is.

They Did Not Know

PRODUCTION MEN who realize that sales and production are interdependent and equally essential may be interested in this one. A prominent manufacturer lost 1,500,000 odd dollars in orders. He analyzed the reasons why his competitors beat him to the dotted line: 22 per cent were lost because the salesmen were outsold; 4 per cent were lost on reciprocity arrangements; 2 per cent, price; 31 per cent for various reasons; but 41 per cent because neither the company nor the salesmen knew that an order was going to be placed until the deed was done. It might not be such a bad idea for you to check up on the advertising and sales record of your own company. You can't make 'em unless they sell 'em.

Self-Tapping

WITHIN the past few years, industry has been given all sorts of new joining mediums. One of the newer is the self-tapping screw used instead of machine screws in some assemblies. A recent comparative study at the Edison Electric Appliance Company showed about 1,090,000 of these screws used annually in assembling various types of electric appliances. In spite of the company's large number of models and sizes, screw sizes have been standardized at four, the number used per assembly varying from 4 to 108. This particular company saves $386 per 100,000 assemblies of a vent cover and deflector, using 300,000 self-tapping screws.

Many Carbon Tools Still in Use

SOME IDEA of the time taken to introduce new materials for cutting tools may be had by noting the number of carbon drills and taps that are still being made. Carbon steel is still used in approximately one-third of the drills while with taps and dies it is about a neck and neck race. In lathe tools also carbon steel still hangs on to about 40 per cent of the business. There are, of course, many places where carbon steel is just as efficient and should be used. But it is a safe bet that there are many places where high speed steel or some of the newer cutting alloys would save a lot of money.

Three-Wire Measurement of Screw Threads

THE measurement of screw threads for accurate work, such as taps and gages, is often done by means of either a special screw-thread micrometer with V points or with an ordinary micrometer and three wires. Since in both methods the reading given by the micrometer is other than the nominal size of the screw, some shops have adopted, at least for lathe use, the three-wire method using a common micrometer and a different size of wire for each pitch of thread. The size of wire is calculated to give a reading equal to the nominal outside diameter of the screw, thus making lathe work more easy, and offering less likelihood of error.

Wire diameter may be obtained from these formulas, where P is the pitch of the thread:

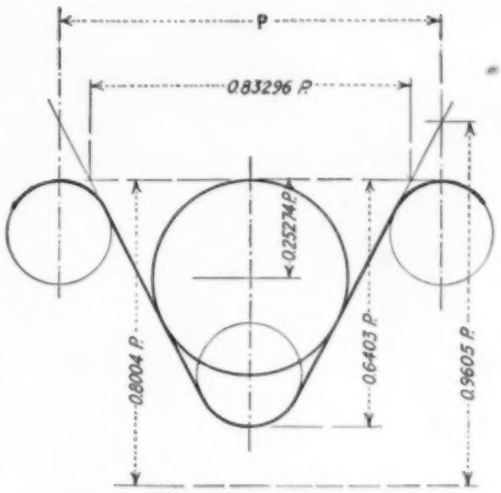
United States Standard $= 0.5052P$

Sharp V thread $\left(\text{with flat at top and bottom equal to } \frac{P}{25}\right) = 0.5542P$

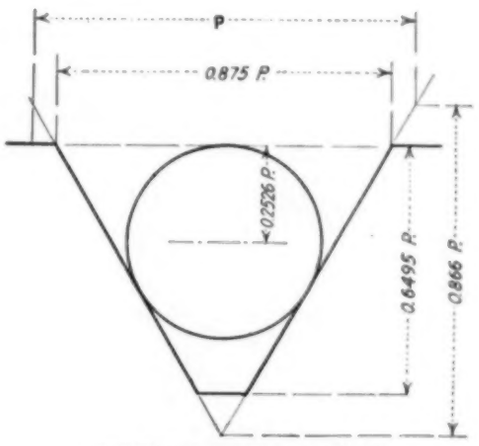
Whitworth Standard $= 0.5055P$

Threads Per Inch	Pitch, Inches	Wire Diameter, Inches — Whitworth	U.S.S.	Sharp V
2½	0.4	0.2022	0.2021	0.2217
3	0.333	0.1685	0.1684	0.1837
3½	0.2857	0.1444	0.1443	0.1583
4	0.25	0.1264	0.1263	0.1385
4½	0.2222	0.1123	0.1122	0.1231
5	0.2	0.1011	0.1010	0.1108
5½	0.1818	0.0908	0.0907	0.1004
6	0.1666	0.0842	0.842	0.0924
7	0.1428	0.0722	0.0722	0.0792
8	0.125	0.0632	0.0632	0.0693
9	0.1111	0.0561	0.0561	0.0616
10	0.1	0.0505	0.0505	0.0554
11	0.0909	0.0454	0.0454	0 0502
12	0.0833	0.0421	0.042P	0.0462
13	0.0777	0.039	0.039	0.0426
14	0.0714	0.0361	0.0361	0.0396
16	0.0625	0.0316	0.0316	0.0347
18	0.0526	0.0280	0.0280	0.0308
20	0.05	0.0252	0.0252	0.0277
24	0.041	0.0210	0.0210	0.0231
26	0.0384	0.0195	0.0195	0.0213
32	0.0312	0.0158	0.0158	0.0173
40	0.025	0.0126	0.0126	0.0138

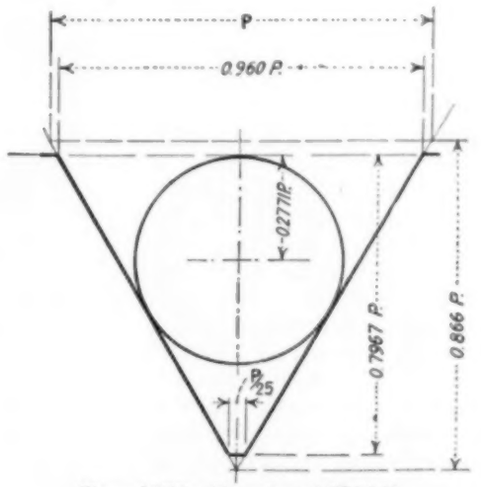
Contributed by James R. Cornelius



Whitworth Wire Diameter = 0.50548 P



U.S.S. Diameter of Wire = 0.5052 P



Sharp V Wire Diameter = 0.5542 P

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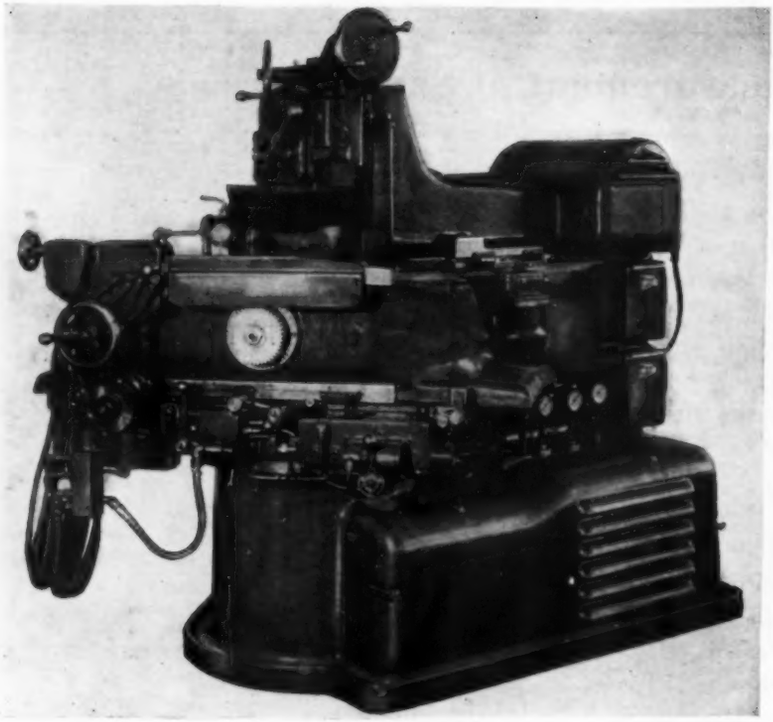


Fig. 1—Front quarter view of the Pratt & Whitney 10-in. hydraulic gear grinder showing the table swivelled for right-hand helical gears

Pratt & Whitney 10-In. Hydraulic Gear Grinder

GRINDING spur and helical gears after hardening at a cost no greater than finish cutting is the chief feature of the 10-in. hydraulic gear grinder announced by the Pratt & Whitney Company, Hartford, Conn. In many cases, the machine will finish gears after hardening faster than present methods before hardening. Errors in tooth form or spacing will not exceed 0.0002 in., making for better running qualities such as quietness and longer wear.

There are two general classes of machines for grinding the teeth of spur or helical gears. One uses a formed grinding wheel and is similar in principle to form milling. The other method uses either one or two wheels whose profile represents one or both sides of a flat-sided basic rack, which is the origin of the involute spur or helical gear tooth system. If a single flat-sided wheel is used, only one side of a gear tooth can be ground in one operation, but if the wheel has two sides trued to the cone which represent the basic rack, both sides of the gear tooth can be ground simultaneously. The P&W hydraulic gear grinder is of the latter type.

A reciprocating horizontal ram carries the grinding wheel back and forth through the teeth, generating the adjacent sides of two teeth at once. The wheel is trued with straight sides and top, corresponding with the shape of a tooth in the master rack. The stack of gears being ground is rolled past the reciprocating wheel under the guidance of a master gear and rack, so that the wheel always engages the work, tooth for tooth, as the master rack engages the master gear. The wheel makes as many passes per tooth as necessary to obtain the finish desired. After the work has rolled to one side out of engagement with the grinding wheel it is indexed automatically. The machine stops automatically when all teeth are finished.

Power for the machine is supplied by two motors. One 3-hp., 1,800-r.p.m. motor is carried in a housing

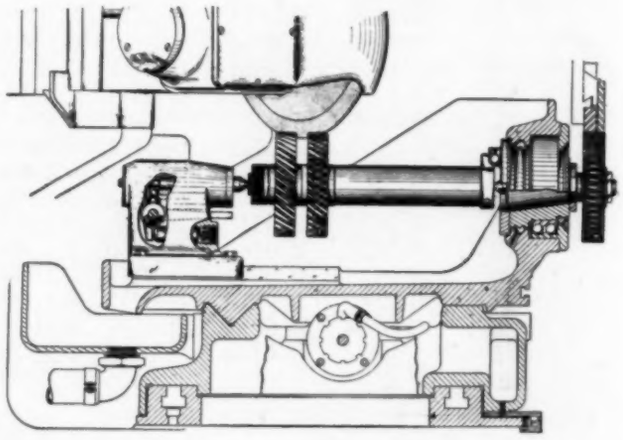


Fig. 2 — Sectional view of the table and work spindle, showing the master rack and master gear at the right-hand end of the spindle

on the ram, and drives the wheel spindle through a belt which is tightened by a spring idler pulley. Spindle speeds of 2,215 and 2,500 r.p.m. are provided, which give surface speeds up to 7,000 ft. per min. One 3-hp., 1,200-r.p.m. motor is mounted under the cover on the side of the bed and is direct connected to two geared oil pumps and one centrifugal water pump. This motor supplies the power for the entire hydraulic system.

The reciprocating horizontal ram that carries the grinding wheel is operated by means of a 2¾-in. piston motor, which can produce ram speeds up to 50 ft. per min. Oil enters the ram motor through a reversing and speed control valve on the right side of the machine, and exhausts through the same valve back to the tank. The ram speed is controlled by a relief valve. Reversal is accomplished without shock even at full speed. The entire ram assembly weighs about 1,100 lb. and is held in position by its own weight. One V- and one flat-bearing are used, the design being self-adjusting for temperature and wear. By means of two dogs which operate the reversing valve, the ram stroke is adjustable for length and position. Maximum stroke is 6½ in.

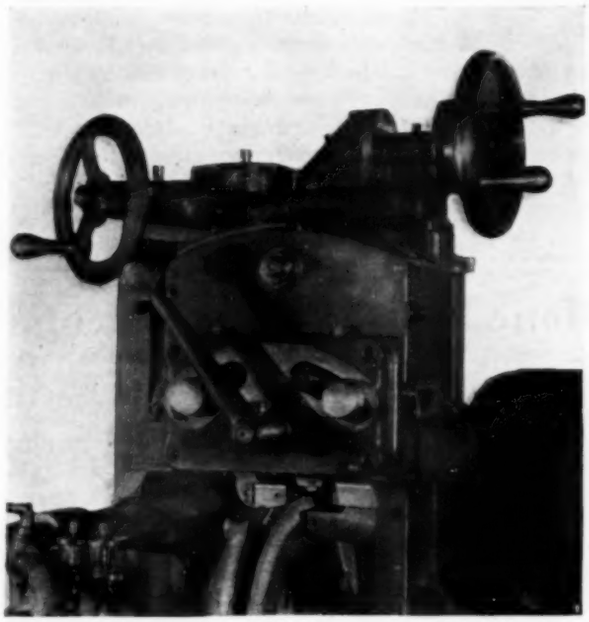


Fig. 3 — Close-up of the wheel dresser with guard removed. All three diamonds are operated simultaneously by the ball handle lever at the front

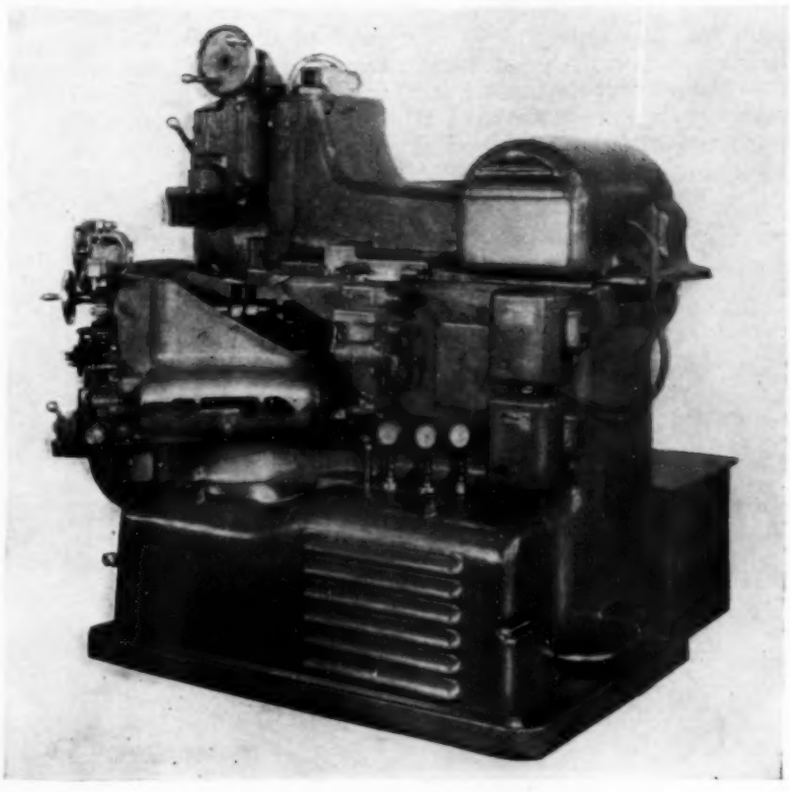


Fig. 4 — Side view of the Pratt & Whitney 10-In. Hydraulic Gear Grinder, showing the ram control valve just above the pressure gages and ram reversing dogs just above the valve

SPECIFICATIONS

CAPACITY:

For Involute Spur or Helical Gears:
Pitch diameter, maximum, in. 10
Pitch diameter, minimum, in. 1
Diametral pitch, maximum 3
Diametral pitch, minimum 16
Pressure angle, deg. ..... 13 to 30
Helix angle, either right or left hand, deg. 45
Width of face, maximum for spur gears, in. 6
For helical gears, width of face may be less than 6 in., depending on the helix angle
Wheel diameter, in. 12

SPEEDS:

Wheel spindle speeds, r.p.m. ..... 2,215 and 2,500
Ram speed (hydraulic), ft. per min. Up to 50
Wheel spindle motor speed, r.p.m. ... 1,800
Pump motor speed, r.p.m. 1,200

FLOOR SPACE: ..... 66x82x67 in. high

WEIGHT: lb. 5,400

The wheel is dressed by three diamonds, one in each of three sliding bars operated by a single lever. The two bars for dressing the sides of the wheel are independently adjustable by a vernier to angles from 13 to 30 deg., by minutes.

The table is driven by a 3-in. piston hydraulic motor and is reversed automatically. Table bearings are of the same type as for the ram—one V and one flat—pressure lubricated, self-aligning and self-adjusting. The table has two speed ranges, a slow one for the grinding operation and a rapid one for indexing. The speed is changed automatically from one range to the other by means of dogs, which operate a valve to control the hydraulic motor. For rough or finished grinding the slow speed can be varied by moving a lever. The rapid speed can be varied separately by means of another valve.

Gear blanks to be ground are mounted on regular grinding arbors and a driving dog. The spindle is

mounted in a large double-row ball bearing made especially for this service and preloaded to 500 lb. The work spindle is removable from its taper seat so that special spindles can be used for unusual cases. The footstock spindle holds the arbor tight on the centers by spring pressure, and is actuated by the horizontal lever shown on the side. To accommodate arbors or work up to 14 in. long, the footstock itself is adjustable on scraped ways.

For spur gears the center line of the work is parallel to the ram movement, and the work slide moves perpendicularly to the center line of the work. For helical gears, the work slide, which is mounted on a swivel base, is set to the helix angle of the gear to be ground, the ram movements remaining unchanged in direction. The work slide, as before, moves perpendicularly to the center line of the work. The helical gear is thus generated by the same combination of straight line and rotary movements as the spur gear.

A master gear is mounted on the end of the work spindle. This master is a duplicate of the gear to be ground in number of teeth and diametral pitch, and is thus of the same pitch diameter as the work. However, it does not need to be a duplicate in pressure angle. Both the master gears and the racks used with them are made of hardened and ground steel, and one three-piece master rack is required for each diametral pitch to be ground. Master gears may be made from cast iron when the runs are short, in order to save tooling cost.

The master rack is mounted on an arm, which pivots horizontally to bring the rack in mesh with and just above the master gear. The pivot is adjustable vertically for master gears from 1 to 10 in. pitch diameter. Immediately above the master rack there is a slide on which are mounted two indexing racks. These are so placed that they are continuations of the master rack on each end. The indexing rack slide moves between adjustable stops, and is moved the distance between two rack teeth at each end of the table stroke. It is operated by a hydraulic piston motor, which is controlled automatically by a valve. The motion of this slide indexes the master gear and the work, as its motion rotates the master gear one tooth. Indexing takes place at either end of the table movement while the master gear is out of mesh with the master rack and in mesh with either indexing rack, the work at the same time having rolled to one side out of contact with the wheel.

Oil for all the hydraulic motors except the ram motor is supplied by the second geared pump which draws oil from the same tank that supplies the ram motor. The second pump is used so that the rapid changes of oil pressure caused by the ram reversals will not affect the motion of the other hydraulic motors.

After each full revolution of the work the hydraulic drive to all parts is stopped automatically by a ratchet wheel mechanism, which is operated hydraulically. The ratchet wheel has the same number of teeth as the work, and operates as a knock-off after one revolution of the gear being ground has been completed. The entire hydraulic system can be started and stopped at any time instantaneously by an emergency lever conveniently located on the front of the machine. All indexing, reversing and speed controls are hydraulic and are interlocked where necessary.

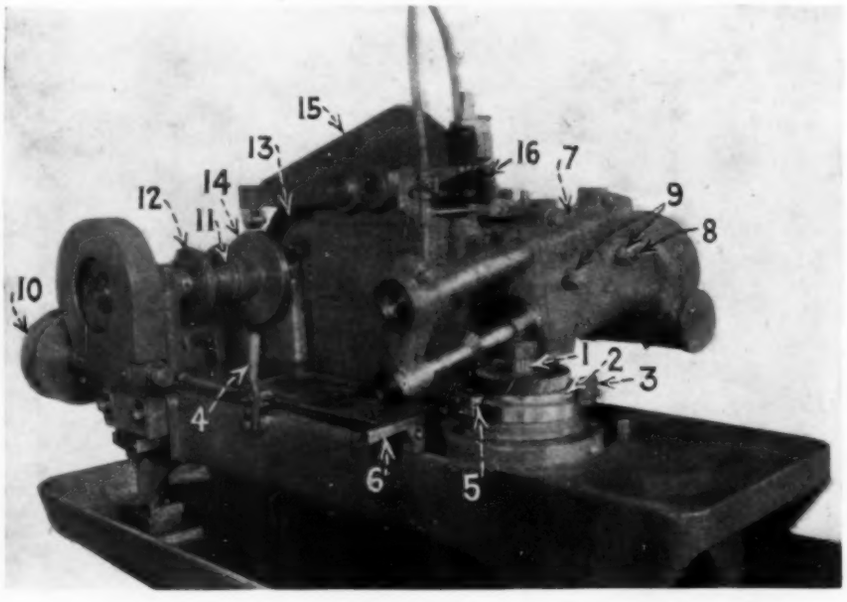
The gear grinder can be changed over for different gears with a very small extra tooling expense. Of the parts previously described, the master gear, master rack, indexing racks, and ratchet wheel are the only ones which must correspond to the particular gear being ground. Replacing these few parts adapts the machine for a different gear. One operator can maintain production on several machines without trouble.

Producto-Matic No. 41 Milling Machine

For milling the undercut type side teeth of hook-tooth cutters and also for milling on an angle to produce a straight land on the side teeth, the Producto Machine Company, Bridgeport, Conn., has developed the No. 41 Producto-Matic vertical work spindle machine. The feature is the tilting cutter block and the indexing plate which is changed to suit the cutter being made. These features are responsible for quick set-up.

The machine is entirely automatic, with the exception of the loading and unloading of the work. The work is held on the work arbor (1), against the work table (2). Cutters are located from the teeth milled on the periphery by means of the adjustable work locater (3). Work arbors have a No. 12 Brown & Sharpe taper and are interchangeable with other arbors. After the work has been located and tightened, the feed is engaged by by means of the lever (4). The machine continues milling the work until all teeth are finished, and stops automatically. Feed is tripped by means of the trip dog (5), which engages with the trip latch (6).

Elevating the cutter while on the return stroke eliminates cutter marks



in the work and permits indexing on deep teeth. A relieving motion up to 1 in. is provided.

The undercut tooth is obtained by swiveling the cutter spindle bearing (7). This spindle bearing is mounted on a cross slide which swings with it. When the bearing has been placed at the proper angle, the bolt (8) is tightened. This secures the crossrail and holds the cutter bearing at the proper angle so that it can be adjusted longitudinally. After the cutter has been set in relationship with the work, the cutter bearing is tightened by means of the two nuts (9), which clamp the bearing, cross-slide and vertical slide securely together. The cutter bearing can be swiveled to an angle of 15 deg. on either side of the center line, making the included angle 30 deg.

The machine is operated by a single camshaft driven by the worm and worm gear. (10) is the pulley which drives the camshaft. Cam (11) indexes the work table, and cam (12) locks the table after the indexing has been completed. Cam (13) gives the horizontal stroke to the cutters, and cam (14) the vertical stroke. On the opposite end of the cut lever (15) is a micrometer adjustment. The micrometer finger travels on the cut templet (16) which produces the angular cut. Different angles or horizontal cuts can be obtained by providing the proper cut templets.

The machine is particularly designed for production milling of high-speed steel cutters, and the stroke ranges from 0 to 3 in. It has a capacity for milling side teeth in cutters up to 7 in. in diameter.

Paasche Type F612, ½-Hp. Portable Air-Painting Unit

Portable equipment for air painting of factory interiors or heavy equipment has been placed on the market by the Paasche Airbrush Company, 1909-27 Diversey Parkway, Chicago, Ill. This Type F612 unit makes use of a ½-hp. motor which can be plugged into a 110- or 220-volt circuit. The base of the equipment is mounted on rubber-tired rollers to provide easy portability. The compressor unit is equipped with a copper cooling coil with a water and oil separator to provide clean, dry air. The 2x2-in. double-cylinder air compressor is driven by a composition belt.

Paasche Portable Air-Painting Unit with extra equipment

As supplied, the equipment includes the air compressor and motor, a safety valve, gage and fittings, and 15 ft. of electric cord. The illustration shows this equipment plus a pressure feed tank, metal-lined fluid hose, and couplings.

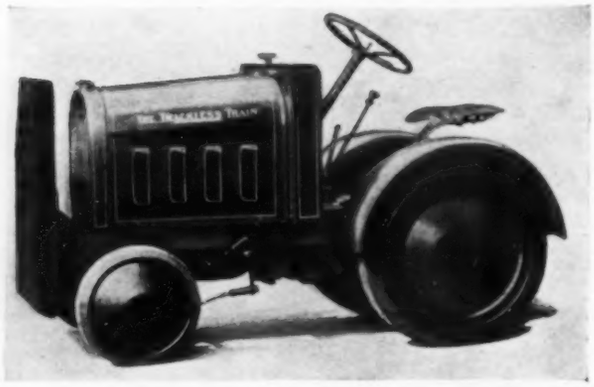
Jorgensen Thread-Tool Grinding Fixture

For grinding thread tools, John Jorgensen, 465 Maplewood Ave., Bridgeport, Conn., has developed a series of grinding fixtures for grinding not only the flanks but the clearance. These fixtures are made for both 29- and 60-deg. thread angles and will take tool bits up to ⅜ in. square. The "Standard" 60-deg. fixture is adapted for use with all V or U.S.S. fine threads where the helix angles are not over 5 deg., as this fixture grinds only the V and the flat of U.S.S. fine threads. The "Precision" 60-deg. fixture will grind tools from 0 deg. to very high helix angles. This fixture grinds on the top or cutting edge of tool at the same setting of the pointer as for the proper helix angle. The "Precision" 29-deg. fixture is for grinding on the top or cutting edge of the tool at the same setting of the pointer as for the graduation corresponding to the helix angle to be cut.

Mercury Type "D" Industrial Gas Tractor

In designing the Type "D" unit the Mercury Manufacturing Company, 4118 S. Halstead St., Chicago, planned the machine from the ground up to meet the specific motive power requirements of an industrial tractor. Its chief features are compactness, short turning radius, ample draw bar pull, and balanced design.

With the engine governed at 1,750 r.p.m., the machine will run light at 13.5 miles per hour and at this speed has a normal draw bar pull of 750 lb. Ultimate draw bar pull in first speed with single rear wheels is 2,500 lb. and with dual rear wheels 3,000 lb.



Mercury Type "D" Industrial Gas Tractor

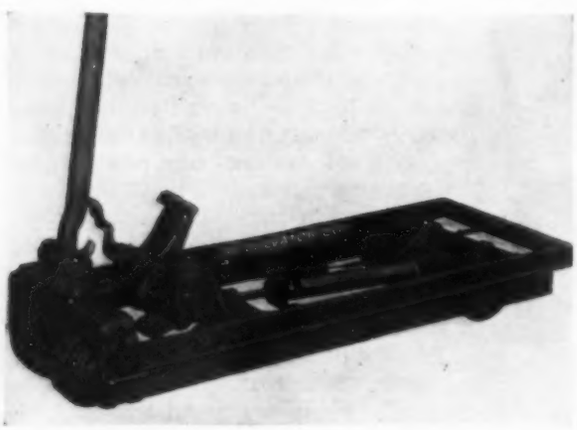
The wheel base is 54 in., over-all length 85 in., and outside turning radius 104 in. With single tires the over-all width is 45 in.; 57 in., with dual tires.

For the Type "D" power plant the Ford Model-A industrial engine with the Model-AA truck clutch and 4-speed transmission have been selected. The S.A.E. rating is 24 hp., but the engine will develop 39 brake hp. at 2,200 r.p.m. Final drive is through the Mercury patented balanced internal gear, used in the Mercury Type "R" larger gas tractor for some years. Standard Ford controls are used.

"Red Giant" Model H Lift Truck

A "Red Giant" Model H Lift truck has been placed on the market by the Revolvator Company, 336-352 Garfield Ave., Jersey City, N. J. The model H-2 is 18 in. wide and is built in platform lengths from 30 to 54 in. to give load capacities from 2,500 to 5,000 lb. The model H-3 is 26½ in. wide and has load platforms from 36 to 72 in. in length to give load capacities from 2,500 to 5,000 lb. On either type of truck the load may be raised with a single stroke of the handle, the standard lift being 1¾ in. A high lift can be had if desired.

Among the features of the truck are: A rolling cam release to give easier operation and save wear of the latch; central suspension to hold the upper frame in central position; a non-kicking tongue, which is detached by dumping the truck; a double (intermediate) latch, which allows the operator to pause in changing his position when lifting the load; no shafts turning in the side bars; and a welded rear link unit. In addition, these trucks have a balanced handle, heat-treated steel links, rounded rear corners, Hyatt roller bearings, and an Alemite lubricating system.



"Lukenweld" Welded Rolled Steel Gear Blanks

All-welded rolled steel gear blanks for use in the manufacture of cut gears are available from Lukenweld, Inc., a division of the Lukens Steel Company, Coatesville, Pa. The welded steel gear blanks, which can be employed in the manufacture of spur, herringbone and helical gears, can be made in any size from 24 in. O.D. up. The largest size manufactured to date has a shipping weight of 4,350 lb., and is 66¾ in. O.D., 11¾ in. width of face, 4⅛ in. thickness of rim and 22½ in. diameter hub.

Although the all-welded gear blanks are ordinarily made from S.A.E. 1020 carbon steel, the rims can be furnished in steels of special analyses if desired. Hubs of the gear blanks are gas-cut from rolled steel plate. Ribs are also cut from plate and formed into channels of the required section. Webs are arc-welded to the hubs, and the reinforcing channels to the webs. The final operation is bending the gear ring and arc-welding it in position. Before shipment, the gear blanks are annealed.

In the manufacture of these all-welded gear blanks, no patterns are required, as the gas-cutting and arc-welding are done with blueprints of the gear design as the guide. This feature eliminates pattern cost, and permits prompt manufacture and shipment. Other advantages are the homogeneity of the thoroughly-annealed rolled steel and freedom from blowholes, gas pockets, hard or spongy spots and other defects.

Greenfield "Tru-Lede" Taps

High-speed steel taps ground in the thread and on the shanks have been placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass., under the trade name of "Tru-Lede." These taps have a permitted lead tolerance of 0.0005 in. in one inch of thread, as against 0.003 in. on cut-thread taps. They have the same pitch and major diameter tolerances as cut-thread taps for producing Class 2 fits. Shanks are ground concentric with the threads, which prevents the taps from wobbling and cutting oversize because of eccentricity. They are said to require less power to drive, operate with less friction, and can be run at higher speeds, besides giving longer wear and lower cost. The taps are offered in hand, machine screw and gun styles in all standard sizes.

"Milwaukee" 1200 and 1800 Series Duplex Milling Machines

Duplex milling machines of the production type, with spindle speeds up to 1,000 r.p.m., and table feeds up to 100 in. per min., have been announced by Kearney & Trecker Corporation, Milwaukee, Wis. Known by the trade name of "Milwaukee Duplex," these machines are basically constructed for the use of tungsten and tantalum carbide milling cutters. Outstanding among the many features are the strength and rigidity embodied throughout the entire design, so that the higher speeds and faster feeds of these cutting alloys may be fully attained.

Three speed ranges are available, these being 15 to 150 r.p.m.; 30 to 300 r.p.m.; or 100 to 1,000 r.p.m., each of which has 12 speed changes. The changes to each spindle are made independently so that cutters of different sizes can be used as desired. In addition, it is possible to provide one spindle with any one of the three speed ranges, and the opposite spindle with either of the other two. This feature will permit the accommodation of work that requires the finishing of a small face on one side and a much larger face on the opposite side.

There is also a choice of three ranges of feeds, namely ½ to 20 in. per min.; 1 to 40 in. per min.; or 2½ to 100 in. per min. Each range has 18 individual feeds. The power rapid traverse for the table is 240 in. per min.

The Duplex machine is made in both 1200 and 1800 Series. The table for the 1200 Series is 12 in. wide, and is furnished with longitudinal power feeds of either 18, 24 or 30 in. The table for the 1800 Series is 18 in. wide and can be equipped with power feed of either 24 or 30 in.

Each spindle is mounted in a heavy forged quill, which is heat-treated, hardened and ground. These quills are 7 in. in diameter and are provided with independent cross adjustment of 7 in. each. Movement of each quill is by a handcrank attached at the front side of the machine. Each quill is provided with a heavy brace that ties it directly to the overarm, so that the quill receives a rigid support throughout its cross adjustment.

Each spindle is driven by herringbone gears which are unusually heavy in construction and hardened. The drive differs from usual practice, inasmuch as the large gear is solidly attached to the spindle and the driving pinion is splined to the pinion shaft. This feature insures a positive, smooth drive to each spindle throughout the entire cross adjustment of the spindle quills and overcomes backlash.

The double overarms of each spindle block can be laced together, as shown in Fig. 2, so that both spindles lie in the same plane. Likewise, these brackets are designed so that the overarms can be bolted together regardless of the vertical position of each spindle block. If, for example, it is necessary to have one spindle higher than the other, the connection may be made as shown in Fig. 3. This method of tying together the overarms, spindle braces and quills forms a rigid truss.

The spindle blocks are mounted between two uprights and are aligned by bearing surfaces for their full length. They are guided by a deep tongue slide and held to adjustment with a full-length gib.

An innovation in table design is the method of mounting the dogs in a fully-inclosed compartment to prevent interference by chips. This compartment is accessible through a sliding door which can be withdrawn when adjustment of the dogs is required.

The machine is automatically lubricated throughout by means of a geared-type pump which is driven from the main drive shaft. This pump is located on the pulley side of the clutch so that it is brought into operation as soon as the motor is started. A large geared-type pump is used to distribute the coolant. The drive for this pump is located on the opposite side of the clutch so that it operates only when the spindle is rotated. The pump is driven by a sliding gear that can be disengaged by operation of a small lever.

All rotating members of the machine, with the exception of the spindle noses, are fully inclosed. This feature is highly important from a standpoint of safety. In Fig. 1 at *A* is shown the method of guarding the flywheel and the rear end of the arbor bolt. The hinged guard protects the draw-in bolt and can be lowered by releasing a thumb screw.

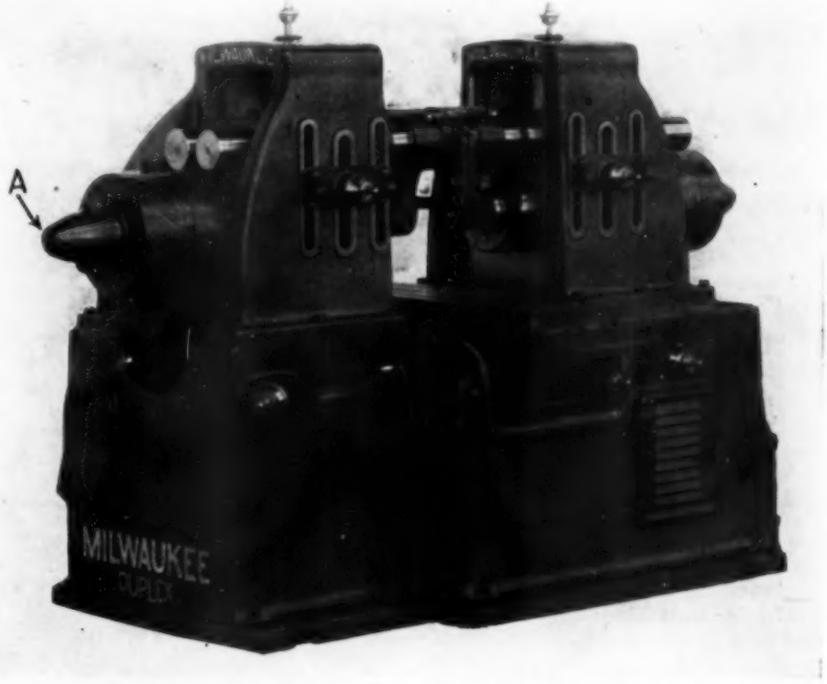


Fig. 1—"Milwaukee" Duplex Milling Machine, which is obtainable with spindle speeds to 1,000 r.p.m. for the use of tungsten and tantalum carbide

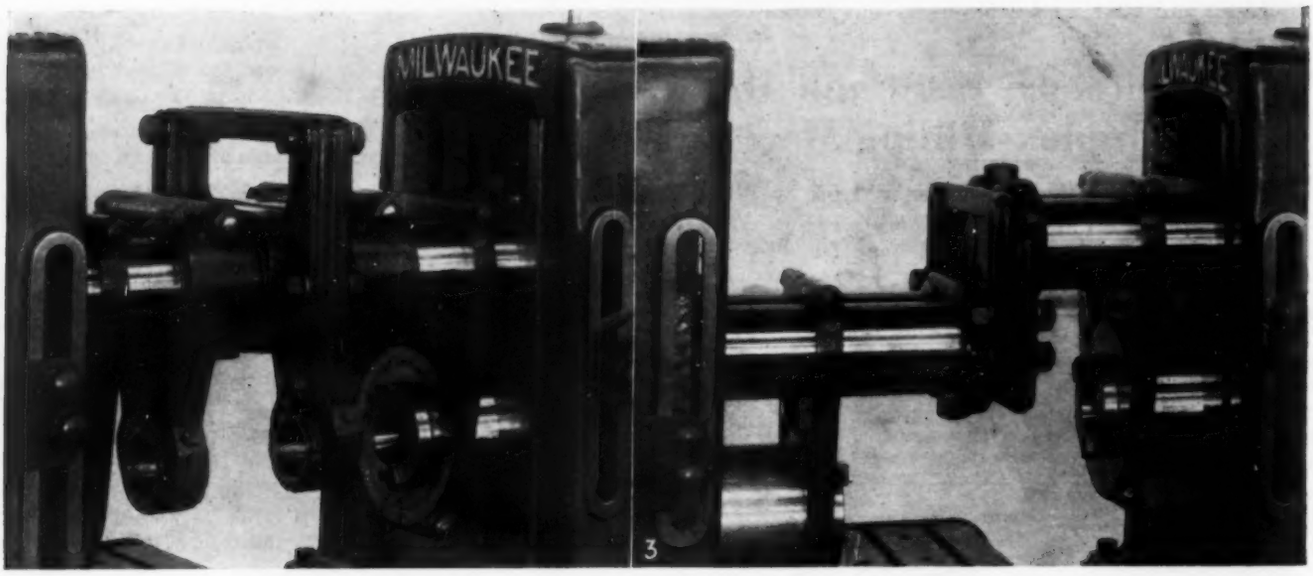


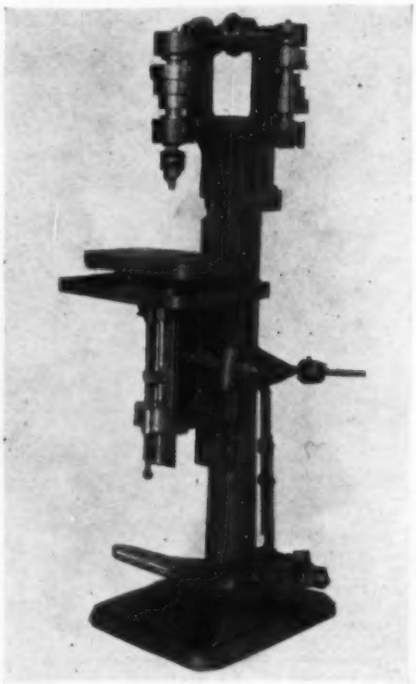
Fig. 2—On the "Milwaukee" Duplex Milling Machine, the double overarms of each spindle block can be laced together. Fig. 3—Where this connection must be made with one spindle higher than the other, it is made as shown in this illustration

The machine is equipped with a multiple V-belt drive, consisting of four belts. Adjustment of the belts to proper tension is attained by adjustment of a pivoted bracket on which the motor is mounted. The motor compartment is cooled by a circulation of air, which is drawn inward by the fan-type spokes of the main drive pulley. All machines are arranged to accommodate either 7½ or 10-hp. motors.

Frew No. 1 Upright Drilling Machine

Contrary to general practice, on this drilling machine the work is raised to and lowered from the drill. The table is counterbalanced and is operated by the treadle, or a hand lever. The drill press has been announced by the Frew Machine Company, 128 West Venango St., Philadelphia, Pa.

The machine is adapted for accurate jig drilling or similar work. Mounted on the column on a dovetailed way is a knee, which can be raised or lowered and locked in position to give the major adjustment between the spindle and the table. This knee carries the gear which meshes with the rack fitted into the table slide and which is operated by a treadle. The table slide is quite long, and is furnished with a stop screw that can be set for the length



of stroke desired. An adjustable raising and lowering mechanism is provided, so that the height of the treadle can be set to suit the operator.

On the top of the column is mounted the head unit, which consists of two spindles running in ball bearings, each spindle fitted with a three-step cone, and the rear spindle in addition fitted with a driving pulley belted to the countershaft. The three-step cone permits three spindle speeds. The spindle can be arranged for either a chuck or furnished with a taper. In case direct motor drive is required the motor is mounted on the back of the head unit, taking the place of the back shaft, and the three-step cone is mounted on the motor shaft.

Specifications: Capacity, up to ½-in. drill; size of table, 15x10 in.; maximum distance from spindle to table, 14 in.; center line of spindle to column, 7 in.; floor space required, 32x20 in.; net weight, 680 lb.

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MAY 5, 1931

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Means for Making Bearing Linings or Sleeves. Berger Stockfletch, Niles, Mich., assigned to Hydraulic Pressed Bearing Co. Patent 1,803,513.

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Boring Machine. Gerrit Vanderbeek, Beloit, Wis., assigned to Yates-American Machine Co. Patent 1,803,740.

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Metal-Working Machinery

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Blank Feeding Mechanism for Punch Presses. Walter Kowal, New York, N. Y., assigned to Phoenix-Hermetic Co. Patent 1,805,336.

Clamping Device. Vernon E. Walters, Detroit and Irving Grant, Grosse Pointe Park, Mich., assigned to General Motors Corporation. Patent 1,805,443.

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Inductor Type Furnace. Edwin Fitch Northrup, Princeton, N. J., assigned to Ajax Electrothermic Corporation. Patent 1,805,150.

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VOL. 74 NO. 21

The Association's Part

PRESIDENT HOOVER, speaking recently before the United States Chamber of Commerce, remarked upon the definite need for a "certain degree of cooperation between individuals in order that we may reduce and eliminate industrial waste, lay the foundation for constant decrease in production and distribution costs, and thereby obtain the fundamental increase in wages and standards of living." One of the important ways of achieving this cooperation is considered by the President to be trade associations, of which he expressed strong approval in the concluding sentence of his message, "Every development of industry renders trade associations more essential to sound development of our economic system."

During the past few years, the growth of trade associations has been little short of phenomenal. They have been built up into major organizations, some of them enrolling more than 75 or 80 per cent of the companies in their particular fields of business. Nearly fourteen thousand national conventions were held in 1930 by various groups, and this was supposedly an "off year!" Yet these organizations find their memberships slipping, the interest of members falling off, and other difficulties besetting them as soon as industry faces a period of economic stress. All the principles of cooperation and fair play which associations have so laboriously instilled are forgotten overnight.

Several things may aid other associations in avoiding similar eventualities. One is the arrangement of really adequate and authoritative programs at meetings; another is concentration upon the original ideals and a lessening of the effort to assume other functions not in keeping. The American business man is definitely committed to meeting his competitors on an even footing and to talking over common difficulties with other individuals similarly interested. It is the job of the trade association to continue to present him this opportunity, and in a way that he will consider worth his while.

What Do You Mean by Overhead?

EVERYONE talks glibly about overhead and yet few refer to the same items that go to make up the cost of doing business. A recent set of "Don'ts" says "Don't forget that in times of depression your overhead may run as high as 300 per cent and in good times never less than 90 per cent." The only useful part of the suggestion is a reminder that overhead, whatever it includes, may be much larger in dull times than in good.

All who are familiar with shop costs know that with direct labor as a base, overhead goes up as we decrease labor cost by improved methods or by introducing better machinery. And yet many continue to measure management efficiency by this very misleading yardstick.

So far as comparisons go it matters little how we figure overhead if we all use the same method. But when some lump every expense under that head while others charge part of the costs of business to other headings. satisfactory comparisons are impossible. Managerial associations can do much good by standardizing definitions of overhead, expense, machine burden, plant burden, and any other expenses that must come out of the treasury before a real profit can be had. The particular division of expense is far less important than that we all speak the same language regarding it.

Training Programs

THOUGHTFUL production managers are predicting a shortage of skilled mechanics, of the type known as "all-round," when production gets into full swing once more. Only when a depression as severe as that through which we have been passing exists is there a surplus of such men.

During good times the more progressive companies conduct training programs of various sorts to provide for future needs. But during dull times, just when extra effort should be put on training, most of these training programs are discontinued to reduce expense.

Here is one more indictment of our system of business management. The more one sees of the failures attributable to poor management the more one gets to feel that some drastic improvements will have to be made if the present system is to survive.

NEWS OF THE WEEK

Small Industries Plan Convention

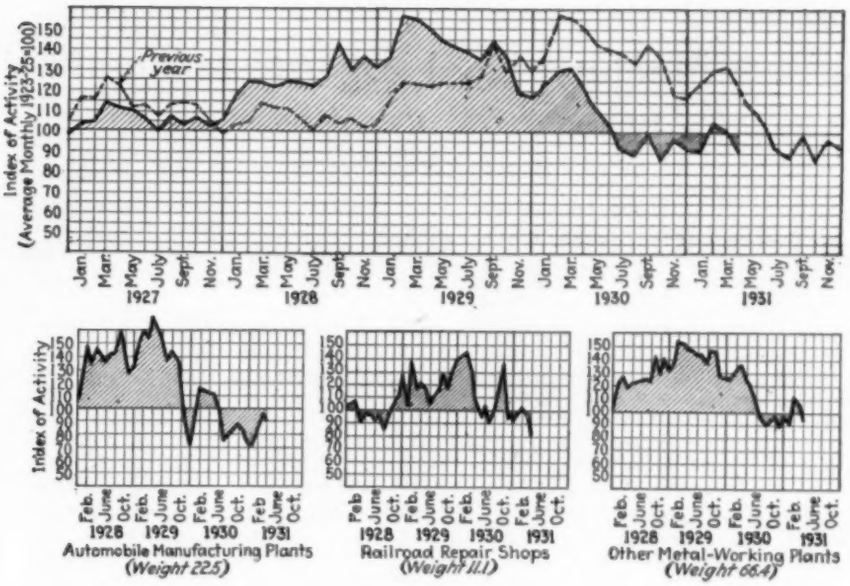
A convention of the smaller industries of the country is to be held Aug. 10, at Lake George, N. Y., under the chairmanship of Harold F. Browne, Manager of the Industrial Relations Department, National Industrial Conference Board, 247 Park Ave., New York, N. Y. The significance of the convention was pointed out recently in a statement issued by the Board, showing that, according to latest available census figures, only 3.4 per cent of all manufacturing establishments in the United States employ more than 250 wage earners and only 1.4 per cent employ more than 500. Further, 62 per cent of all industrial wage-earners are employed in plants having a working force of 500 or less.

The report claims that the factor of size has been largely ignored in previous conferences on management problems. Large plants have held the stage because of their greater attention to the questions under discussion.

AT THE annual meeting of the American Iron & Steel Institute in New York, the following new directors were elected for the term expiring the first Monday in May, 1934: E. R. Crawford, President of the McKeesport Tin Plate Co., W. W. Holloway, President of the Wheeling Steel Corporation, Frank Purnell, President of the Youngstown Sheet & Tube Co., and Harry E. Sheldon, President Allegheny Steel Co.

"UNEMPLOYMENT Insurance in Great Britain," the second of a series of comprehensive studies of the unemployment relief question, as dealt with in the United States and foreign countries, has just been released by the Industrial Relations Counselors, Inc., 165 Broadway, New York, N. Y.

SIMPLIFIED Practice Recommendation R17-31 on Forged Tools, submitted to industry for criticism and comment under date of March 19, has been O.K'ed by a sufficient number of manufacturers, distributors, and users to make it effective as of July 1.



April Metal-Working Operations Show Further Decline

A FURTHER slowing up in activity from a final figure of 105.7 in February and 100.3 in March to 92.4 in April is indicated by reports on the consumption of electrical energy for power purposes, continuing a period of mixed trends. All figures given in these summaries are corrected for 26 working days.

The automobile shop index, given as 72.9 for January, 88.9 for February and 94.1 for March, dropped to 90.8 in April. The railroad repair shop index for January of 95.6, for February of 102.1, and for March of 94.3, dropped to 82.8 in April. This compares with 91.8 in December and 97.8 in November, 1930. Ferrous and non-ferrous metal-working plants outside the two groups aforementioned have an April index of 94.6, as compared with a March index of 103.5, a February index of 112.3, 92.9 in January, 97.8 in December and 99.4 in November, 1930.

When the figures are adjusted seasonally, however, slight changes occur. The railroad repair shop index drops from 82.8 to 80.1, as compared with 90.3 in March and 90 in February. The automobile figure drops from 90.8 to 76.0, as compared with 88.2 in March and 85.3 in February. The "other metal-working" figure drops from 94.6 to 92.4, as compared with 95.3 in March and 100.7 in February. This gives a seasonally adjusted figure for the group of 87.9, as compared with 92.9 in March, 95.9 in February, 87.7 in January and 100.5 in December.

N.A.P.A. Meeting In June

"Industrial Purchasing's Perspective" is the title of the discussion to be led by Prof. Howard Thompson Lewis of the Harvard Graduate School of Business Administration at the 16th annual international convention of the National Association of Purchasing Agents in Toronto, June 8-11, at the Royal York Hotel. Papers include "How are prices made and how should they be made?" by Dr. Leverett S. Lyon of Brookings Institution; "Estimating Material Costs for Budget Purposes," by H. N. McGill of the McGill Commodity Service; "What Determines Prices of Commodities in International Trade?" by Floyd S. Chalmers, Editor, "Financial Post"; "The Future of Rubber," by F. A. Seiberling, President of the Seiberling Rubber Co.; "Industrial Textiles" by Robert Bowe of the Hunter Manufacturing & Commission Co.; "Future Chemical Developments and their Probable Effect," by Dr. Harrison E. Howe, Editor, "Industrial & Engineering Chemistry"; "Mining & Mineral Developments in Canada," by Hon. Charles Camsell, Deputy Minister of Mines of the Dominion of Canada; and "Standards and Specifications for Paper," by R. H. Simmons of the Technical Staff of the United States Government Printing Office. Group and committee meetings will be included.

Business Men To Visit Russia

During the summer of 1930 Dr. Henry R. Seager, of the Faculty of Political Science of Columbia University, and a group of economists and business men went to Russia to make a study of the Soviet five-year plan. Dr. Seager made arrangements with Soviet officials to interview American business men who might visit Russia during the summer of 1931, and Roy H. Mackay is carrying out the arrangements and will lead the trip.

German Machine Tool Exports to Russia Increase 70 Per Cent

By Our Berlin Correspondent

RECENTLY, a number of leading German industrialists visited Russia on an informatory trip. It should be pointed out that they did not undertake this visit of their own accord, but rather through a special invitation by the Central Board of Industrialization of the U.S.S.R. By inviting the German industrialists to visit Moscow, Charkow, Leningrad and the industrial centers, such as the Donez territory, the intention of the Board of Industrialization was to induce Germany to grant further credit agreements and supplies, needed by Russia in order to carry out the five-year plan. The importance of the visit is clearly demonstrated by the fact that the leading executives of the largest concerns in the German machine industry took part.

Due to the trip, negotiations were taken up afresh and have already shown results. In Berlin, on April 14, an agreement was signed by the German industrial combine and the Russian Board of Industrialization, according to which, for the purpose of an extension of German-Russian commerce, new orders totalling approximately 150 to 160 million dollars were to be placed with the German industry in the period of April 15 to Aug. 31, 1931. Until now this constitutes an increase of 70 per cent of Russian purchases in Germany, as compared with 1930. Of course, these orders do not pertain to machines only, but the whole German industry. Nevertheless, in order consistently to carry through the five-year plan, necessitating the procuring of iron structures, ironworks, blast-furnaces, boilers, transportation means, and the complete equipment of manufacturing plants, the German machine tool industry will share in these orders to a considerable extent.

Total exports of German products to Russia amounted to approximately 130 million dollars in 1930, as compared with but 102 million dollars in 1929. The largest shares were those of the heavy machinery industry, that is 25 million dollars in 1930, as compared with 7 million dollars in 1929; in the second place the machine tool industry is to export 20½ million dollars in 1930, as compared with 8½ million dollars in 1929. This is followed by the electrical industry with 17.2 million dollars in 1930 and 8.3 million dollars in 1929. The shipbuilding industry even more than doubled its exports to Russia during last year; they totalled 7.3 million dollars in 1930, compared to 3.2 million dollars in 1929.

One of the most severe conditions—such conditions as had been refused them by American firms—were the Russian proposals of payment. Formerly, they had usually placed their orders with credits extending over periods of 12, 14 or 21 months. Now, down-payments of 20 per cent are to be made in drafts at more than 1½ to 2 years when ordering; for the balance they demand even longer terms of payment, resulting in average credits extending over periods of 14, 21 or 29 months. These conditions represent a serious draw-back to German industry on account of the extraordinary strain on the German finance market, as well as the resources of the various manufacturers, owing to the reparations payments and resultant high taxes in Germany.

However, in order to assist German industry in carrying through these orders, the German government is in earnest considering to warrant the payment, and thus the financing, by means of credit-guarantees. This is, of course, in view of the possibility of combating, at least to some degree, the unemployment problem by means of the ensuing additional activities of the manufacturing plants; it is estimated that approximately 50,000 more workmen will be kept occupied by these Russian purchases. One might almost believe that the Russians are taking advantage of the difficult economic situation of the German industry in order to attain the most favorable buying conditions possible. A comparison of the conditions granted the Russians by England and by Germany clearly shows the disadvantage of the latter. As far as known in England, Russia pays 10 per cent of its purchases in cash when ordering and the balance in 42 equal monthly installments, which, moreover, are guaranteed by accepted drafts.

On the whole these new Russian purchases will have considerable, though not exactly decisive, bearing upon German export trade.

In the last two months Russian trading organizations ordered the following items in Germany:

Technocharsnab, Moscow:	
From a German ball-bearing manufacturer, ball bearings to a value of	$357,000
Stankoimport, Moscow:	
From a western German machine tool manufacturer, horisontal boring and milling machines, as well as automatic knife hammering machines	119,000
From a central German machine tool manufacturer, high-speed lathes	71,000
From a southern German machine tool manufacturer, measuring devices	48,000
From a Saxon machine tool manufacturer, heavy-duty turret lathes, more than	50,000
The Importassociation Metallimport, Moscow:	
From a central German machine tool manufacturer, special sheet shears, drilling and milling machines, as well as measuring devices at a value of	95,000
Total	$740,000

When surveying the German export trade in machine tools alone, one must come to the conclusion that the German machine tool industry shares in total German exports to Russia at an exceedingly high rate, as has always been the case. In the last few years its share has steadily increased. Russia is to be regarded as the best consumer of German machine tools.

A survey of the operations of German makers of metal-working machinery, presents the following aspect:

Year	Total Exports of German Metal-Working Machines	Russian Quota Per Cent
1924	$12,726,000	2.38
1925	18,404,000	4.59
1926	24,285,000	12.14
1927	27,707,000	30.33
1928	33,682,000	18.97
1929	43,414,000	11.20
1930	52,419,000	20.46

E. C. Bullard Honored

Edward C. Bullard was given a testimonial dinner at the Hotel Stratfield, Bridgeport, Conn., Thursday evening, May 7, to mark the occasion of his appointment as general manager of The Bullard Company to succeed his uncle,

E. C. Bullard

the late Stanley Hale Bullard. Remarks were made by Pres. E. P. Bullard of the company, Mayor Buckingham, and others prominent in civic and industrial affairs in Bridgeport. A feature of the evening was a special honor table at which were seated "Old Timers" of the Bullard organization. Twenty-three men comprised this group, and the total number of years of service they represented with The Bullard Company was 734, an average of 32 years each.

GROUP winners in the Annual Steam Railroad Accident Prevention Contest have been announced by the National Safety Council. The awards conclude an initial seven-year drive launched in 1923. A comparison of the 1923 figures with those of 1930 show that there were 1,084 fewer fatalities on American railroads last year than in 1923 and 114,963 fewer injuries. This represents a 52.6 per cent reduction in fatalities and a 77.6 per cent reduction in injuries.

World Markets for Industrial Machinery Shift During 1930

WASHINGTON, D. C., May 16—Exports of industrial machinery from the United States during 1930, in spite of a decline of about 14 per cent as compared with the record figure established in the preceding year, reached the imposing total of $220,913,000, and indicate a continued demand abroad for this class of American goods in the face of increasing competition from European countries, according to the Industrial Machinery Division, Department of Commerce. The tendency throughout the world to meet the requirements of modernized industry has resulted in a preference for specialized machinery, and the superiority of American designs has enabled manufacturers in this country to overcome foreign competition based on lower prices and long-term credits. This constantly growing desire abroad to learn more about American methods of production is well illustrated by the accompanying table showing the steady rise in foreign shipments of American machinery since 1922.

In 1930, world business depression, political disturbances in several of the Latin American countries and in Europe, and unsettled conditions in the Far East contributed to a decline in American machinery exports of about $36,000,000 as compared with 1929. However, despite these unfavorable factors, exports of machinery from the United States in 1930 exceeded substantially the totals established in all other years since the abnormal post-armistice period, representing a gain of almost 7 per cent over 1928 and more than doubling similar American exports in 1922. This business is especially noteworthy in view of the fact that, although one would expect the decline in industrial machinery to exceed almost any other commodity, the general export trade of the United States dropped about 26.7 per cent during the same period.

For the third successive year, Europe surpassed all other areas as a market for American industrial machinery, absorbing equipment valued at $89,125,000, far in excess of any year since the post-armistice period. The significance of this increase is particularly striking in view of the extremely competitive conditions existing in the European market. As in previous years, metal-working machinery of highly specialized types accounted for the greater portion of this trade, important quantities going to Soviet Russia.

Shipments of industrial machinery to other principal marketing areas in 1930 also were of surprising importance. Canada, including Newfoundland and Labrador, although falling below the level reached in the previous year, continued to maintain its position as the leading individual consumer of American machinery, reaching the creditable figure of $46,664,000. As usual, metal-working machinery, mining machinery, and construction and conveying equipment were the three leading items.

Sales to South America, Mexico and Central America, and the West Indies also dropped below the 1929 figures, comparing more favorably with the totals for the years immediately preceding that period.

The most outstanding development of the period was the exceptional gain in sales of industrial machinery to Soviet Russia in Europe. This country almost trebled its purchases of the previous year and continues the substantial increase which has been made year by year for the past 8 years. The Russian trade was responsible in a large measure for the extremely favorable showing made by shipments of American machinery to Europe. As a result Russia displaced the United Kingdom as the second principal individual market.

Comparative value of foreign markets for American industrial machinery exports

Country of Destination	1927 Rank	1927 Value	1928 Rank	1928 Value	1929 Rank	1929 Value	1930 Rank	1930 Value
Canada	1	$38,380,941	1	$49,221,231	1	$65,657,691	1	$45,839,005
Soviet Russia in Europe	10	6,580,346	6	8,406,436	3	13,737,779	2	39,791,765
United Kingdom	2	25,048,034	2	24,434,630	2	26,538,061	3	22,152,652
Mexico	3	9,176,395	3	10,010,900	4	12,327,459	4	11,895,617
France	12	4,821,147	4	8,697,575	5	12,005,549	5	8,456,691
Argentina	6	7,049,837	5	8,522,463	6	8,986,441	6	7,881,478
Chile	13	4,729,767	19	2,824,417	13	5,625,673	7	6,828,473
Japan	9	6,608,655	7	7,468,635	8	8,050,989	8	6,275,022
Germany	7	6,874,638	9	6,297,528	9	7,092,520	9	5,343,328
Venezuela	5	7,411,590	8	6,373,066	7	8,309,684	10	5,156,050
British South Africa	16	3,191,765	17	3,280,716	18	3,889,262	11	4,179,697
Brazil	11	5,031,311	11	5,391,267	11	6,362,846	12	4,037,275
Netherlands East Indies	18	2,886,993	16	3,546,726	12	5,964,823	13	3,568,133
Australia	8	6,863,377	10	5,524,536	10	6,710,519	14	3,459,234
British India	15	3,940,719	15	3,623,773	15	4,067,382	15	3,201,865
Philippine Islands	19	2,761,229	13	4,617,510	16	4,056,533	16	2,561,461
Cuba	4	8,170,799	12	5,160,060	14	4,434,439	17	2,553,474
Italy	21	1,841,895	20	2,618,479	17	3,905,280	18	2,384,548
Rumania	33	865,637	23	2,099,893	22	3,285,873	19	2,084,338
Soviet Russia in Asia	54	145,416	45	448,440	40	708,366	20	1,910,398
Greece	51	199,758	55	242,210	41	628,204	21	1,846,634
Spain	20	2,200,502	18	3,007,157	19	3,750,142	22	1,817,168
Colombia	14	4,405,082	14	4,332,546	21	3,567,441	23	1,708,367
Belgium	28	927,172	22	2,119,823	23	2,517,663	24	1,701,024
China	27	1,024,288	24	1,885,193	25	2,253,894	25	1,585,812
Peru	17	2,965,207	21	2,280,962	24	2,486,691	26	1,550,909
Sweden	23	1,157,009	27	1,327,822	26	2,135,467	27	1,459,790
Trinidad and Tobago	25	1,068,894	36	629,758	33	1,124,975	28	1,221,345
British Malaya	22	1,283,560	29	1,238,026	28	1,775,408	29	1,190,116
Portuguese Africa	30	911,020	41	501,253	39	761,385	30	1,175,828
Netherlands West Indies	38	461,384	25	1,717,158	20	3,590,002	31	1,162,034
Persia	(1)	(1)	(1)	(1)	(1)	(1)	32	1,100,354
Netherlands	24	1,108,902	28	1,311,733	27	1,805,901	33	1,093,921
Panama	(1)	(1)	(1)	(1)	(1)	(1)	34	1,008,952
Newfoundland and Labrador	35	581,219	42	494,576	31	1,167,370	35	825,588
New Zealand	26	1,024,657	34	833,960	30	1,300,934	36	825,531
Uruguay	29	912,782	32	966,400	29	1,457,870	37	817,720
Norway	37	466,734	39	541,213	38	796,549	38	774,892
Czechoslovakia	49	224,367	33	950,536	35	863,065	39	699,628
Bolivia	34	679,090	31	974,301	34	994,432	40	657,254
Denmark	40	412,574	40	505,295	42	590,261	41	558,988
Morocco	(1)	(1)	(1)	(1)	(1)	(1)	42	502,922
Switzerland	41	362,424	43	483,333	37	799,133	43	468,694
Algeria and Tunisia	(1)	(1)	(1)	(1)	(1)	(1)	44	459,715
Kwantung	36	523,228	44	469,151	36	820,872	45	401,345
Honduras	47	278,837	47	413,493	47	371,644	46	376,763
Irish Free State	(1)	(1)	26	1,644,814	53	237,826	47	370,763
Hong Kong	44	321,634	49	369,708	51	285,022	48	363,861
Ecuador	46	292,073	37	575,204	46	423,419	49	341,553
Finland	45	318,729	46	422,633	45	425,123	50	324,249
Egypt	(1)	(1)	(1)	(1)	(1)	(1)	51	307,287
Canary Islands	(1)	(1)	(1)	(1)	(1)	(1)	52	300,119
Poland and Dantzig	42	339,466	48	413,522	43	547,535	53	267,767
Azores and Madeira Island	(1)	(1)	(1)	(1)	(1)	(1)	54	261,088
Nicaragua	50	215,422	53	267,566	52	255,042	55	253,166
Guatemala	39	417,156	51	328,191	50	329,432	56	226,092
Dominican Republic	31	910,245	35	733,158	44	455,959	57	216,226
Total includ. other countries		$183,168,687		$206,211,738		$257,085,110		$220,913,051

(1) Not separately classified.

United States Exports of Industrial Machinery

(In thousands of dollars)

Country and Place of Destination	1925	1926	1927	1928	1929	1930
Canada, Newfoundland, etc	$24,134	$31,072	$39,000	$49,727	$66,867	$46,664
Europe (except Balkans)	45,698	38,342	53,225	63,830	78,787	89,125
South America	26,228	34,685	33,685	32,427	38,465	28,108
Mexico and Central America	13,005	11,721	11,527	13,302	15,184	14,077
West Indies	13,100	7,561	11,345	8,965	10,255	5,852
Total Latin America	$62,433	$53,967	$56,557	$54,494	$63,904	$48,037
Asia (except near East	16,682	19,249	19,740	24,024	28,321	21,380
Australia-New Zealand	6,039	7,425	7,928	6,460	8,085	4,284
Africa	3,251	4,539	5,084	4,689	6,504	7,120
Other countries	1,252	2,011	1,635	2,988	4,727	4,299
Grand total	$149,339	$156,605	$183,169	$206,212	$257,085	$220,913
Percentage to:						
Latin America	35.1	34.5	30.9	26.4	24.9	21.8
Asia	11.1	12.3	10.8	11.6	11.0	9.6
Canada, Newfoundland	16.2	19.3	21.3	24.1	26.0	21.2
Europe	30.6	24.5	29.0	31.0	20.6	40.3
Australia	4.0	4.7	4.3	3.1	3.1	1.9
Africa	2.2	2.9	2.8	2.3	2.5	3.3
Other countries	0.8	1.3	0.9	1.5	1.9	1.9

A. M. A. Schedules Production Conference

The Annual Production Conference of the American Management Association is to be held at the Chamber of Commerce, Rochester, N. Y., on June 1-2, with the general subject "Control of Overhead." Thomas R. Jones, Vice-President in Charge of the Production Division, and Vice-President and General Manager of the Harris-Seybold-Potter Co., will be in charge and the Industrial Management Council of the Rochester Chamber of Commerce, the Management Division of the A.S.M.E., and the Rochester Chapter of the N.A.C.A., will cooperate in the meeting. Sessions Monday morning, June 1, will include papers on "The Effect of Design on Overhead" by O. D. Reich, Vice-President of the Dexter Folder Co., and "Engineering and Shop Standardization," by Thomas R. Jones. Papers that afternoon will be "The Relation of Building and Equipment Design and Layout to Overhead Reduction" by W. J. Austin, President of The Austin Co., and "The Relation of Machine and Equipment Layout to Overhead Costs," by E. C. Brandt, Assistant Works Manager, Westinghouse Electric & Manufacturing Co. W. F. Coleman, Vice-President of the W. A. Jones Foundry & Machine Company, will preside at the morning session and E. S. La Rose, Assistant Comptroller of the Bausch & Lomb Optical Co., will preside at the afternoon session. James Gleason, President of the Gleason Works, will preside at the dinner meeting that evening, at which a paper, "A Marketing Manager Looks at Manufacturing Overhead," will be presented by L. R. Boulware, General Sales Manager, Syracuse Washing Machine Corporation.

Tuesday morning's session will be presided over by Edward A. Halbleib, President of the Delco Appliance Corporation, and James G. Marshall, General Superintendent of the Union Carbide Co., will present a paper "Reduction of Fixed Charges by Use of Three Shifts." The second paper of the morning will be "Organization for the Elimination of Indirect Labor and Clerical Effort," by Theodore Clark, Works Manager of the Bauer & Black Division, The Kendall Co. Two papers will also be presented at the afternoon session with H. H. Lang, Comptroller of the Stecher Lithographic Co., presiding. "The Costs of Indirect Expense During Seasonal and Cyclical Fluctuations of Business" will be presented by C. S. Carney, Vice-President, The Trundle Engineering Co., and "The Methods to Bring Under Control the Ever-Increasing Ratios of Indirect to Direct Effort" will be presented by Raymond S. Perry, Assistant to the President of The Ingersoll Milling Machine Co. Discussion on the first topic will be led by A. Weiland, and on the second by H. G. Perkins.

Ralph Stewart MacPherran, Chief Chemist of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., received the latest award of the Whiting Gold Medal, presented by the A.F.A. during the recent annual meeting for Mr. MacPherran's many contributions to the gray iron foundry industry. This is the third time in its eleven years of existence that the award has been made

France and Italy Also Sell Machinery and Tools to Russia

FRANCIS M. MANSFIELD
Paris, France

SOVIET purchases of production goods in European countries are continually increasing in volume and value.

The rhythm of Soviet orders in France in the last few months appears to have slowed down. Orders for the last month of 1930 showed a decrease of 54 per cent as compared with 1929. Specifically, the Metalloimport Section in Paris placed orders in December for an equivalent value of but $327,848. Electrical machinery and appliances ran to $316,721, and non-ferrous metals to $264,216.

Italy's participation in Soviet trade is increasing rapidly, amounting to 13,400,000 Moscow roubles in 1930 as against 8,000,000 roubles in 1929. In 1930, 72 per cent of such Italian exports were accredited to industrial and agricultural products as against 48 per cent the year before. Automobiles and motor trucks in 1930, accounted to 35 per cent of the total—actually 4,700,000 roubles.

A Soviet-Italian commercial treaty just signed provides for an annual expenditure in Italy of 175,000,000 lire, apportioned as follows: Ships 50 million, railway material 25 millions, machinery 25 millions, automobiles and farm machinery 20 millions, airplanes 30 millions, electric motors etc. 25 millions, chemical products 25 millions. Italy on its part is to take petrol products, lumber, minerals and forage for cattle.

The foregoing figures of the volume of Soviet trading suggests a possible discounting in years to come of the Soviet claim of the United States trading balance of $90,000,000 in 1930. Especially is it evident that Soviet Russia is more than ever looking to Germany for much of its machinery and tool equipment, basing this upon the figures given with respect to trading in 1930.

Obviously much of this increase is due to a falling off of orders placed in France, but reading the hand-writing on the wall it is also plain that Germano—Russ commercial relations are of a firmer weld than they were, less liable to draw apart and less likely to run against the financial ills which hitherto had kept them separated.

Iron & Steel Institute Meets this Week

Among the papers to be presented at the meeting of the Iron & Steel Institute in New York City tomorrow are those by F. N. Speller, Director, Department of Metallurgy and Research, National Tube Co., who will speak on "Co-operative Research in the Iron and Steel Industry." H. Gerrish Smith, Vice-President of the Bethlehem Shipbuilding Corporation, Ltd., will speak on "Shipbuilding and Its Relation to the Steel Industry," Marcus A. Grossman, Vice-President of the Republic Research Corporation, Massillon, Ohio, will speak on "An Appraisal of Nitriding," T. Holland Nelson, Consulting Metallurgist of the Midvale Co., will speak on "Corrosion-Resistant Alloys of the Stainless Type in Use in Fabrication," Victor Windett, Manager of the Gas Producer Division, Wellman Engineering Co., will speak on "A Review of Certain Gas Producer Practice," and William M. Henry, Chief Engineer of the Newburgh works, American Steel & Wire Co., and Thomas J. McLoughlin, Fuel Engineer, Duquesne Works, Carnegie Steel Co., will speak on "A Thermal Study of an Open-hearth Furnace."

France Finds Herself Affected By Economic Unrest

BY OUR PARIS CORRESPONDENT

RECENT commercial accords with Yugoslavia, Greece, Egypt, Haiti, Chili, Roumania and the Portuguese colonies will doubtless have some beneficent results for French industry, though their influence on American trade is more remote. What is more important is the held-up Franco-Spanish bi-lateral commercial agreement which may be expected to be carried to completion by the newly installed Spanish government. Here the American machinery and electrical trades may find some curtailing opposition.

In general all French transforming industries have been affected, no less those of the metal manufacturing trades. The machine tool trades are booking few new orders. Stocks of raw materials are running low requiring renewal at no distant date, regardless of whether demand for manufactured goods increases greatly or not. Reorganization is the order of the day in many of the plants, suppression, absorption, and combination taking place on all hands. Actually, many of the smaller plants established since the war have shrunk to still smaller proportions and may now be considered as merely specialist shops. If any precise movement is to be visioned it is that of a concerted campaign towards curtailing the import of not only consumer goods but likewise of production machines.

The Annual Assembly of French Manufacturers has just set forth an admonition to its members in the statement that the effort "must be carried on towards more economical manufacturing methods, though handicapped, as it is, by what is otherwise an admirable French quality—prudence."

There has been a marked slowing down in the local production of agricultural machinery, with the result that there is little inducement for the installing of new tools, machinery, or accessories. Both within France and in the export market competition from the United States and Germany is set forth as the dampener on a branch of the trade which for three years has been making notable headway.

That ever-reliable barometer of trade activity, the automobile, shows that France has still less of a grip on foreign distribution since the first of the year than a year ago. Fewer expensive cars have been sent abroad which, coupled with the drop in the medium priced car, has resulted in a diminution in value of 51% for the quarter and in bulk 28%. It is noted also that the export of commercial vehicles shows an increase in the price unit, not so much due to the superior vehicle as to more costly production methods than apply to touring cars.

The French wage scale of 1931, on the base of 38 manufacturing trades, shows the hour rate stands at the index of 891 and the day rate at 732, the gold franc value being at 100.

Eastern Chapters' Group Meeting, A.S.S.T.

For the third time in as many years, the New York, New Jersey, Lehigh Valley, York and Philadelphia Chapters of the A.S.S.T., assembled for a one-day group meeting in Philadelphia, Pa., May 15. Some 500 members and guests enjoyed the program. At the morning technical session was read and discussed an informative paper, "Centrifugal Processes of Pipe Making," by Dr. F. C. Langenberg and S. B. Clark, of the United States Cast Iron Pipe & Foundry Co.

The Philadelphia Electric Co. was host at a luncheon at the Penn Athletic Club. A short address by George Whitwell, Vice-President of that company, followed. During the afternoon the officers of the Philadelphia Navy Yard were hosts, conducting the party through the Naval Aircraft Factory, the yards, the shops and the battleship "Wyoming." Dinner at the Penn Athletic Club topped off the day. Gabriel Heatter of Edgar T. Ward's Sons Co., and Mayor Mackey, of Philadelphia, were the speakers.

BUSINESS ITEMS

The Ramet Corporation of America, North Chicago, Ill., has been formed to take over United States and Canadian rights in "Ramet" metal, developed by the Fansteel Products Co., Inc., North Chicago, Ill. This corporation is a wholly owned subsidiary of the Fansteel Products Co., Inc. Officers are: J. M. Troxel, President; C. E. Stryker, Vice-President & General Manager; E. F. Radke, Secretary & Treasurer. Ramet Corporation has acquired the United States and Canadian patent rights and contracts formerly held by the parent company and has an exclusive agreement with the company covering the supply of raw materials as well as the continuance of research on Ramet in the Fansteel laboratories. Fansteel will continue its activities in the rare metal field, including tantalum, tungsten, molybdenum and columbium, together with certain finished products embodying these metals.

The Pacific Car & Foundry Co., Seattle, Wash., has purchased the Arrow Pump Co., Seattle, and will add this equipment to the plant at Renton. The same company has also purchased the drop forge equipment and business of the Bacon & Matheson Forge Co., Seattle, whose plant was recently damaged by fire. This also will be added to the car company's Renton forge plant, making it independent of outside forge shops. C. H. Bacon has retired, but Scott Matheson will be associated with the Pacific Car & Foundry Co.

The Standard Spring & Manufacturing Co., Ltd., San Francisco, Calif., has been organized and is producing a complete line of coil and elliptic heavy-duty springs. Machinery has been installed in the South San Francisco plant of the Western Pipe & Steel Co. J. P. Bell, formerly resident vice-president of the Fort Pitt Spring & Manufacturing Co., in San Francisco, is president of the Standard company. F. A. Meckert, also a former vice-president of the Fort Pitt company, is production manager of the new company, and T. C. Blue is secretary and treasurer. Headquarters have been established at 564 Market St.

Arrangements have been made to consolidate the S. R. Dresser Manufacturing Co., and the Merco Nordstrom Valve Co., New York, through the formation of a corporation to be known as the Dresser Nordstrom Co. Dresser manufactures pipe line equipment, while Merco Nordstrom makes lubricated plug cock-type valves. The new company's directors will include the present board of the Dresser Co., with Fred A. Miller as chairman. H. N. Mallon, President of Dresser, will be president of the consolidated company, and Merrill N. Davis will be vice-president.

Expansion of the Fire King Stoker Co., Indianapolis, Ind., through the election of additional directors and the adoption of a greatly enlarged plan of manufacturing and selling activity has been announced. The new board includes E. S. Pearce, Burrell Wright, E. M. Costin, Edward S. Goodrich, and Murray McConnell, in addition to H. Mangell and V. W. Potts, members of the retiring board. Mr. McConnell was named president, succeeding Mr. Angell. The latter was elected vice-president, and Mr. Potts was re-elected secretary-treasurer.

Re-establishment and enlargement of the business of the London (Ont.) Rolling Mills Co., Ltd., is to follow the taking over of the rolling mills by the Ingersoll Machine Tool Co., Ltd., and the John Morrow Screw & Nut Co., Ltd. The new owners announce that in addition to the usual production, the firm intends to manufacture alloy steel. A sum of $40,000 is to be spent immediately in overhauling the plant, and approximately $100,000 will be spent before reconstruction has been completed, as one new furnace is to be installed.

Judge Edwin C. Dickenson has ordered a sale of all assets of the Huntington Aircraft Co., Stratford, Conn. J. Kenneth Bradley was appointed receiver.

Officials of the John Deere Manufacturing Co., Ltd., of Welland, Ont., have been advised by Deere & Co., Moline, Ill., of their decision to open the factory at Welland and resume the manufacture of their line of farm implements for the Canadian trade. C. R. Carlson, Jr., has been selected as manager and R. A. Lang, former superintendent, will again fill the same position. The work of installing suitable machinery and equipment will start in the near future.

The Hill Clutch Machine & Foundry Co., 6400 Breakwater Ave., Cleveland, Ohio, has moved its New York office to Room 606 at 90 West St. Arthur L. Whiteside will continue in charge.

The Diamond Electrical Manufacturing Co. Ltd., Los Angeles, Calif., affiliated with the Square D Co., Detroit, has opened a new branch factory at San Francisco at 130 Potrero Ave. The new building is equipped to manufacture dead front switchboards and other electrical safety equipment. J. J. Mitchell, former branch sales manager of the Square D Cleveland office, has become sales manager of the new Diamond San Francisco office.

The New York offices of the Lorain Steel Co., Johnstown, Pa., a subsidiary of the United States Steel Corporation, New York, will be moved from 71 Broadway to the Empire State Building, Fifth Ave. and Thirty-fourth St., together with the offices of the American Steel & Wire Co., also a U. S. Steel Corporation subsidiary.

The Lisle Manufacturing Co. and the Clarinda (Iowa) Manufacturing Co., have been merged as the Lisle Corporation with Edwin Lisle president. The former concern manufactures automotive machinery for garage work and well-boring machines, and the latter concern has been manufacturing lawn mowers and washing machines.

The Segal Lock & Hardware Co., South Norwalk, Conn., has added special machinery to produce more than 60,000 razor blades per 8-hour day. The company has adopted a production schedule of 200,000 razor blades and 5,000 safety razors daily. Plans are being considered to center this line of business entirely at the Brooklyn, N. Y., plant.

The Airforce Conveyor Corporation, Davenport, Iowa, has been granted a charter with $100,000 authorized capital, to buy and sell grain elevator equipment and handling agricultural, mining, and industrial machinery. A. E. Montgomery is president; B. A. Shearer vice-president; Andrew A. Kopp, secretary; and E. W. Martin, treasurer.

The Power Filter Division of the Square D Co., Detroit, Mich., has been established with offices and works there. M. D. Williamson will be in charge of the new division, which will manufacture Power Filter Units for the conversion of d.c. from a.c. for various electrical units.

Noblitt-Sparks Industries, Inc., has acquired the Hilab Products Co., Indianapolis, Ind.

The Dardelet Threadlock Corporation, 120 Broadway, New York, N. Y., has granted licenses to the Colorado Fuel & Iron Co., for the manufacture and sale of track and commercial bolts and nuts formed with the Dardelet self-locking thread.

The Minneapolis-Honeywell Regulator Co. has moved its Chicago office from 672 Wrigley Bldg., to 2065 Daily News Bldg., 400 W. Madison St.

The David Lupton's Sons Co., has moved its Detroit office to 5-130 General Motors Bldg.

PERSONALS

E. D. Ashworth of the Bethlehem shipbuilding Corporation, Ltd., New York, has been made vice-chairman of the Boston chapter, A.S.S.T.

R. H. Bacon, formerly advertising manager for Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, has been appointed manager of the Pump Sales Division with headquarters in Chicago.

E. H. Ballard, General Foundry and Patent Shop Superintendent of the General Electric Co., at the West Lynn, (Mass.) works, has been elected President of the American Foundrymen's Association. T. S. Hammond, President of the Whiting Corporation, has been elected vice-president of the association. Directors for a three-year term include: N. K. B. Patch, Secretary of the Lumen Bearing Co.; Fred L. Wolf, Chief Engineer and Technical Superintendent of the Ohio Brass Co.; W. D. Moore, President of the American Cast Iron Pipe Co.; A. G. Storie, Fittings Ltd., Oshawa, Ont., and Dan M. Avey, Editor of "The Foundry."

H. T. Bennett, Assistant Manager of Sales at Chicago for the American Sheet & Tin Plate Co., Pittsburgh, became manager of sales there May 1 to succeed W. H. Eaton, retired on pension.

E. C. Bonistall, formerly connected with the Engineering Department of the Pennsylvania Railroad at Altoona, Pa., has been given charge of the Cincinnati district office of the Rollway Bearing Co., Inc., Syracuse, N. Y.

Harry C. Davis, Superintendent of the Mahoning Valley Steel Co.'s sheet plant at Niles, Ohio, has resigned.

W. A. Del Mar of the Habirshaw Electric Cable Co., Yonkers, N. Y., has been named Chairman of the Sectional Committee on Insulated Wires and Cables of the A.S.A. F. J. White of the Okonite Co., 501 Fifth Ave., New York City, is secretary.

F. M. Farmer, representing the A.I.E.E. and A.W.S., has been appointed chairman of the American Standards Association's Sectional Committee on Electric Welding Apparatus.

Fred L. Flanders, formerly chairman of the Muskegon Motors Specialties Co., Muskegon, Mich., a subsidiary of the Houdaille-Hershey Corporation, Detroit, has been elected executive vice-president and general manager of the parent company.

G. O. Frostad, formerly president of the Wisconsin National Fibre Can Co., and mechanical engineer for the Brook's Machinery Co., is in active management of the Krahn Manufacturing Co. plant, Milwaukee, following the vacancy caused by the death of A. W. Krahn, president.

Frank M. Germane, President for the past five years of the Bearings Co. of America, Lancaster, Pa., has become special sales representative at Detroit for the Budd Wheel Co., Philadelphia. Burton W. Brodt, Sales Manager of the Firestone Steel Products Co., Detroit and Akron, Ohio, has rejoined the Budd Wheel Co.'s sales staff after an absence of several years.

C. F. Herington, for the past nine years in charge of sales engineering and erection of pulverized coal plants for Heyl & Patterson, Inc., Pittsburgh, has established an office at 1440 Broadway, New York City, where he will specialize in the sale of pulverized coal and pneumatic and mechanical handling equipment.

J. P. Hilands, for many years eastern sales representative of the Ohio Seamless Tube Co., has resigned and will be succeeeded by W. S. Thompson, who has been identified with the New York office.

F. Van Rossen Hoogendyk spoke on "Diesel Engines" on May 20 at a meeting of the Metropolitan Section, S.A.E. His talk preceded an inspection of the Diesel Motor Ship "Lafayette."

Edward N. Hurley, Chairman of the Board of the Electric Household Utilities Corporation, Chicago, has been elected a director of the U. S. Chamber of Commerce.

Dr. Frederick W. Lancaster of Birmingham, England, has received the Daniel Guggenheim Gold Medal for his contributions to "the fundamental theory of aerodynamics," according to a recent announcement. This is the third award of the medal. Orville Wright and Dr. Ludwig Prandtl received the previous medals.

George V. Lang, Auditor and Assistant Treasurer of the United Engineering & Foundry Co., Pittsburgh, has been elected secretary in addition, to succeed the late George H. Friesel.

Glenn Merrifield, formerly foundry superintendent of the Clark Equipment Co., Buchanan, Mich., has resigned to take a similar position with the Pettibone-Mulliken Co., Chicago.

Julius Muller, formerly with the Henry Vogt Machine Co., Louisville, Ky., has become development engineer for the Leeds & Northrup Co., Philadelphia.

Frederick A. Oefinger was recently elected president of the Plantsville Foundry Corporation, Southington, Conn., to succeed Thomas W. Thomson.

J. C. Milner, formerly vice-president of the Canadian division of International Business Machines Corporation, New York, has become sales manager of the newly-organized Industrial Sales Co. Division, New York.

Geo. A. Orrok, David Moffat Myers and W. A. Shoudy, Consulting Engineers, have moved their offices to 21 E. 40th St., New York City.

H. J. Philip has resigned as manager of the South Market St. plant, Brantford, Ont., of the Massey-Harris Co., Toronto, Ont. C. F. Verity of the Verity Plow Works division has also resigned.

G. A. Pugh, Vice-President of the Aetna - Standard Engineering Co., Youngstown, Ohio, has returned after a 2-month tour of Europe.

Neil E. Salsich, who has been manager of railroad and mining sales for the Bethlehem Steel Co. has been named vice-president and general sales manager for the Jeffrey Manufacturing Co., Columbus, Ohio. He spent 28 years with the Pennsylvania Steel Co. and its successor the Bethlehem Steel Co.

Guy P. Shambo, employed at the Joliet (Ill.) works of the Illinois Steel company since 1917, has been appointed superintendent of the merchant mill at the plant, succeeding George Palmer, who retired May 1 under the corporation's pension plan. Michael Keough succeeded J. W. Dunn as foreman of the boiler shops at the coke plant, when the latter was similarly retired.

William P. Siebert, assistant general manager of sales of the Carnegie Steel Co., Pittsburgh, has retired.

Walter Siegerist has become general manager of Skinner Bros. Manufacturing Co., Inc., St. Louis.

W. W. Wilson, General Motors Bldg., Detroit, has been appointed agent for the Alloy Metal Wire Co., Inc., Moore, Pa.

OBITUARIES

Leo Baum, 47, Superintendent and part owner of J. Baum Safe & Lock Co., Cincinnati, Ohio, died May 11 after an illness of several years.

Alexander Gilliand, Vice-President of the Standard Steel Specialty Co., Beaver Falls, Pa., died May 3 at Bellevue, Pa. He was also president of the Duff Patents Co., Inc., Pittsburgh.

Sam Heppenstall, 88, organizer of the Heppenstall Co., Pittsburgh, and long a prominent figure in the steel industry, died May 11 in Bala, Pa.

Jules-Edouard Lambercier, 69, founder of the firm of J. Lambercier & Co., Geneva, Switzerland, father of the director, Adrien Lambercier, and former associate of Emile Widmer, Administrator, died suddenly after a heart attack on April 24.

George H. Leidiger, 46, Treasurer of the Northwestern Malleable Iron Co., died May 5 after a short illness.

Samuel F. Kallenbaugh, 62, Sales Manager of the Morgan Engineering Co., Alliance, Ohio, since 1928, died May 8. He had been with the Morgan Company over 32 years.

Louis J. Mueller, Jr., 64, President of the L. J. Mueller Furnace Co., Milwaukee, and its subsidiary, the Manufacturers Foundry Co., died May 4.

Ronald E. Parmenter, 38, General Branch Manager of the Heil Co., Milwaukee, died May 1 after an illness of a month.

Benjamin C. Perkins, 45, Vice-President of the Arrow-Hart & Hegeman Electric Co., Hartford, Conn., died May 3 at Liberty, N. Y. Mr. Perkins had been connected with the company since its inception.

William F. Prier, 61, founder and president of the Oregon Brass Works, Portland, died April 21. Mr. Prier began his career in his father's company, the Prier Brass Manufacturing Co., Kansas City, later coming to Portland and opening his own plant in 1906.

J. W. Stephenson, 52, a director of the Anaconda Wire & Cable Co., and the Peerless Motor Car Co., and president of the Indiana Truck Co., Marion, Ind., died May 8 in Chicago.

Robert McCrae Wilson, 59, Consulting Electrical Engineer and formerly associated for 27 years with the General Electric Co., Schenectady, N. Y., died May 6, while on a motor trip through the South. He began his engineering career as a draftsman with the Sprague Electric Co., which later was purchased by G.E. For many years he was in charge of motor construction at the Watsessing, N. J., plant.

William A. Long, 60, for the last 36 years an authority on the cutting and finishing of gears, died at the Providence Hospital, May 3. During this period he worked at the Brown & Sharpe Manufacturing Co., the Barber-Colman Co., Pierce Arrow Co., Franklin Motor Car Co., and since Nov. 2, 1925 has been associated with the Pratt & Whitney Co., Hartford, Conn.

Lewis E. Lockwood, 55, President of the National Transit Pump & Machine Co., died May 8 at Oil City, Pa.

Theodore E. Miller, 81, one of the founders of the Mertes-Miller Boiler Works, Milwaukee, died May 5. He had founded the boiler works in 1870 and retired about 15 years ago.

A. Johnson Monroe, 51, President of the N. S. Monroe & Sons Co., Arthur, Ill., died recently.

Frank G. Wallace, 78, President and General Manager of the Kingston, (Ont.) Locomotive Co., until five years ago, died May 10 at Edgewood, Pa.

FORTHCOMING MEETINGS

National Foreign Trade Council—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

American Society of Mechanical Engineers—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Fourth New England Meeting, Hartford, Conn., June 1-4.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

American Management Association—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

Associated Machine Tool Dealers—Annual Meeting, Granville Inn, Granville, Ohio, June 4-5. A. G. Bryant, c/o Joseph T. Ryerson & Son, Inc., 2558 West 16th St., Chicago, secretary.

National Association of Purchasing Agents—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

National Association of Foremen—Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

Society of Automotive Engineers—Summer meeting, June 14-19, White Sulphur Springs, Va. Green Brier Hotel. J. A. C. Warner, secretary, 29 West 39th St., New York City.

American Society for Testing Materials—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Institute of Electrical Engineers—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., N. Y. C.

National Metal Congress and Exposition — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

National Safety Council—20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., Chicago.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Sales of a few small lathes by one dealer and of repair and replacement units and parts here and there characterize a dull week. Inquiries are in smaller number and are largely discounted by dealers. May is expected to hold even or slip slightly from April. Dealers meet the same litany everywhere, "Not until business gets better," prospects seemingly having forgotten their rush for tools a year and a half ago. They admit they need tools, will require them as soon as "business improves," but cannot be dynamited from their present ostrich-like position. Meanwhile the vicious circle of delayed purchases continues, with industrial "leaders" not only decidedly absent, but also unaccounted for.

DETROIT

May has been a poor month for machinery and machine tool dealers. Sales have dropped below the average for April, and dealers are not expecting an improvement in June. The summer depression is being felt acutely in view of the general low level of trade during the last 18 months. Only a few replacements have been purchased and most of these have been insignificant. Small tools and supplies have sold better than large machinery but even these have been far below normal.

Thus far no word of major changes in car models has come from the engineering staffs of the big automobile concerns. All the large firms have agreed to make their model changes in the fall and it has been expected that these changes would bring a heavy demand for machinery and tools. There is still a possibility that these changes will be numerous and important, but there is now a growing feeling that this hope, like many others of the past year and a half, may soon disappear.

PHILADELPHIA

On the theory that business eventually will improve because there is nothing else for it to do, spokesmen for the machinery and machine tool trade continue to hold an optimistic view of the situation. There was little or no change this week compared to two weeks ago, when leaders of the industry, looking at the situation from a practical standpoint, failed to see any immediate approach to material improvement. The hope that the railroads will shortly be in the market for some machine shop purchases, was expressed by some dealers and sales agents, but there was apparently nothing to base an expectation upon. There was some activity in the used tool line, but no outstanding sales were reported.

NEW ENGLAND

The machine tool trade had another dull week with negligible orders. Further retrenching on the part of domestic buyers has thrown a harpoon into a whale of a lot of New England optimism. It is deplorable this situation should be further accentuated with machine tool requirements steadily mounting.

Dealers and builders have little information tending toward a constructive buying program. It is fairly well established that buying throughout the summer will be routine. On the other hand an incentive for buying may be created at any time, because prospective business is hardly less encouraging; being apparently sidetracked for the time being, probably until Fall.

May to date is certainly running behind April in volume of orders. Industrially some centers reflect a decline in man hours. Veeder-Root, Inc., Hartford, reports good orders for counting equipment. Holyoke, Mass., is preparing a list of tools for manual training departments.

HOLDING EVEN or slipping slightly, machinery and machine tool markets are simply reflecting the condition of general business and the seeming lack of desire to do anything to better its situation. Arguments of tool sellers are met with oft-repeated refrain, "not until business gets better," those who sing it seemingly forgetting the rush for tools not so many months ago and the all-too-evident fact that as soon as business conditions justify the increase, prices of practically every type of machine tool will be increased.

The National Machine Tool Builders' index shows orders for April 105.1; as against March 117.6 and February 83.7. Shipments: April, 91.3; March, 91.9, and February, 72.6. Unfilled orders for April registered 238, against March 225.1 and February 204.4. Plants in class B, (shipments $10,000 to $50,000 in 1922-3-4) showed the best average.

NEW YORK dealers had a quiet week, a few small lathes and replacement parts being sold, while inquiries were slow. The month of May there will hold about even, while in Detroit it has been poor. No major automobile model changes are indicated as yet, and this possibility is beginning to be discounted. Philadelphia expects railroad orders and is selling a few used tools. New England expects May to run behind April in orders and in man-hours worked, with only prospects of manual-training inquiries. Cleveland has had few inquiries or orders in May, although a recent Ohio survey shows that 75 per cent of the plants there need new tools.

MILWAUKEE electrical manufacturers are principal buyers in a market holding at about its April level. There, as in Cleveland, automotive buying is anticipated. Chicago, Cincinnati, and Los Angeles are holding even with sales largely single replacements.

CLEVELAND

The month of May to date, insofar as its relation to machinery and machine tools sales is concerned, is practically devoid of sales. Inquiries in general are comparatively few and without feature. Manufacturers of automatic machinery are somewhat heartened by a few interesting prospects from the automobile industry and this industry is preparing its quotations with a prayer that they mature. A local dealer, agent for several manufacturers in the state of Ohio, recently made a missionary trip through the state covering almost every prospective customer in each city. His survey indicated that 75 per cent of the concerns called upon would replace part of their equipment when conditions warrant.

MILWAUKEE

Machine tool business has not shown any improvement thus far this month, being reported as holding its own without further recession. Orders coming in are well scattered geographically and from diversified sources. Single tools for replacements constitute the bulk of whatver business is being placed, although an occasional order is received for several units. The electrical manufacturing industry leads in buying. One manufacturer reports that office appliance manufacturers have come into the market and that these orders have replaced disappointments from other sources. One of the factors that was expected to help out May business was the automotive industry, but very little business has materialized from this source, and the opinion now is that little can be anticipated for the present. A similar condition exists so far as agricultural implement manufacturers are concerned. General industrialists and machine shops here and there are placing small orders. Inquiries continue about the same. As to prospects for the next few months, it is generally admitted that there are no definite indications of any important upward trend, but prospects for Fall are considered very favorable.

CHICAGO

Indications that business in machine tools for the first half of May at least will hold even with the April average is about the best that distributors and selling agents have to say regarding the immediate outlook. It is not believed, however, that there will be any early improvement in conditions. Road salesmen representing manufacturers of standard tools are quoted as being without optimism with regard to an early pick-up. Inquiries are practically limited to tools indispensable for replacement, no expansion developments of any moment being reported. The used tool market is without change, and dealers specializing in this class of equipment are looking for little if any improvement until Fall. The Santa Fe railroad is said to be well on the way toward final closing on its several lists.

CINCINNATI

Machine tool manufacturers find some satisfaction in the fact that they were able to hold their own in the past week. However, the market continued dull and strenuous efforts of sales departments failed to quicken the business pulse. Local selling agents secured a few single orders and met with some success in developing prospects. In the main, bookings of manufacturers were orders from general machinists and miscellaneous industrial users, and with very few exceptions the requirements were single tools. A fair number of inquiries were received, but none were important, and in most cases they were for but one item. At this time the great majority of inquiries seem to be merely tentative and the experience is that only a small percentage results in immediate sales.

LOS ANGELES

The machine tool and shop equipment business in the Los Angeles district and in Southern California in general presents few elements differing in any important respect from the situation existing at the time of the last report. Some specialty shops find an improvement in their own lines of work and certain of these shops operating with a moderate number of men have been running under fairly uniform conditions month by month. Naturally, as stated in preceding reports, the larger plants engaged principally in oil tool production reflect the general condition which has obtained in the oil fields for some time past.

BUSINESS • BAROMETER

Public willingness to invest must soon affect the present bearish sentiment

THEODORE H. PRICE
Editor, Commerce and Finance, New York

IN THE business news of last week there were four items which command especial attention. One was the extraordinary victory that Briand won for his foreign policy in the French Parliament. His defeat in the presidential race seems to presage his continuance as Foreign Minister, in which position he may be able partially to realize his dream of a European United States, further plans for which have been submitted to members of the League of Nations. It is unnecessary to amplify upon what may happen if this dream becomes a reality.

Then there is the recognition that the silver question is securing on both sides of the Atlantic. At its Washington meeting the International Chamber of Commerce passed a resolution urging that its members should give special attention to the value and importance of silver as money at its next meeting. This resolution was unanimously adopted. A few days later it was followed by a radio speech by Senator Borah that has attracted wide attention by its forceful presentation of the world's need of silver money and the business revival that would probably follow its remonetization on a basis that would reflect its intrinsic value as a medium of exchange. Incidentally the National Metal Exchange of New York will commence trading in silver futures about June 15.

Third in importance is the decline in the money market which has followed the action of the Federal Reserve Bank of New York in reducing its re-discount rate to 1½ per cent. As a result call money has declined to 1 per cent. Some of the "Liberty" issues have advanced to the highest prices on record, and other gilt edge bonds rose concurrently. The Bank of England has reduced its rate to 2½ per cent.

Finally there is the sudden demand for brick that has developed in the metropolitan district. Sales exceed last year's by 35 per cent, and contractors are said to be outbidding each other in their efforts to secure brick that are still too hot to be taken from the kilns. The Dow Service Daily Building Reports said that not since 1921 has common brick still warm from the kiln come into dealers' hands. The present extraordinary demand is said to be due to the financial rehabilitation of many small contractors, made possible by the decline in the money market and the abundance of bank credit. As a result much construction that was temporarily held up has been resumed and the area of brickyard activity is rapidly expanding. As yet the facts are not generally appreciated outside the building trade, but if they are as stated, a summer of great activity in building would seem to be indicated.

To the average observer there may not seem to be a very close relationship between the price of silver and that of brick, but in the metropolitan district alone more than 50,000,000 brick a month are now being used, and the increased demand is significant of a marked improvement in fundamentals.

That "competition is the life of trade" is a proverb which appears to have inspired the Prince of Wales in his Manchester speech. In this speech he was very candid in urging the adoption of American methods by British merchants and manufacturers who transact business with South America. He was frank in admitting the obstacles under which his countrymen were laboring, but his view of the future inspires confidence.

This optimistic view of the situation is confirmed by the steadiness of the commodity markets. The Government report indicates an exceptional increase in the winter wheat crop, but its effect seems to have been discounted, and all the cereals have displayed marked steadiness in the face of statistics and predictions that were intrinsically bearish.

Reports from the Detroit region indicate a continued improvement in the automobile industry. It is not sensational, but it seems to be well sustained. Demand for steel is still slack, but an increase in building activity in the Middle West is generally expected.

On the Stock Exchange there has been a decrease in speculative activity, but the cheapness of money has quickened the demand for gilt edge bonds. Many of the non-taxables have advanced sharply, and while some stocks are lower it seems unlikely that we shall have any serious decline as long as money continues to be obtainable at the low rates now current. For this reason many bargain hunters are now studying the Stock Exchange quotations closely, and it is reported that the demand for "odd lots" reflects a public willingness to invest at present prices that must soon have its effect upon the speculative attitude which has been outspokenly bearish until recently.

The politico-economic clouds which still overhang Russia and have somewhat darkened the skies of Spain have caused misgivings in some quarters, but foreign correspondents who are well informed predict an early return of Spanish tranquillity and some improvement in Russia's internal condition. There is, however, no denying the seriousness of the Russian problem or the enormous advantages which would follow its solution.

THE BUSINESS WEEK

May 20, 1931

At the close of the great national and international business conferences, business sentiment here and abroad seems to have assumed an ultramarine shade of pessimism. . . . This is somewhat surprising, for while the outcome of the conferences was disappointing to those who looked for decisive leadership, the surface signs of the business situation have given no ground for added gloom, and a fundamentally favorable force has appeared in the picture in the form of persistent and powerful Federal Reserve pressure for credit expansion. . . . Our index is holding its level with no indication of impending decline due to more than seasonal changes. . . . The seasonal slackening of steel activity seems slightly slower, with moderately improving prospects of automotive demand. . . . Building permit figures reflect some improvement in residential construction. . . . Check payments and currency circulation suggest some increase in money turnover. . . . Department store results for April indicate increased retail activity. . . . Crop prospects are encouraging, and wheat is surprisingly stable. . . . The full extent and effect of Federal Reserve effort to check chronic credit contraction and overcome commercial bank inertia and conservatism will not be seen for several months, but its pugnacious policy is pointed in the right direction and by every rule of precedent should speed recovery. . . . Increasing stability in stocks and strength in bonds are already reassuring results.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

BUYING of steel materials by the automotive industry and of structurals, reinforcing bars and line-pipe for construction purposes, has done much in the last week to prevent further sagging of the market. Prices of copper, zinc and scrap steel are close to levels of thirty-five years ago. Finished steel, hot-rolled, at $1.65 per 100 lb., base, Pittsburgh, is now at the level of Sept., 1921. Dealers in the New York territory will give but 1c. per lb. for scrap zinc at the present time. Lead oxides are down ½c. per lb. at Chicago and Pacific coast points.

(All prices as of May 15, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@18.76
Virginia No. 2 (Silicon, 1.75@2.25)	22 29
Basic	17.00@17.25
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	17.50
Basic	17.00@17.50
Bessemer	17.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.85	3.35†	3.00	3.20‡
No. 12	1.90	3.45†	3.10	3.25‡
No. 14	2.00	3.55†	3.20	3.30‡
No. 16	2.10	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.05	3.60†	3.40	3.30
No. 22	2.20	3.75†	3.55	3.45
No. 24	2.25	3.80†	3.60	3.50
No. 26	2.35	3.90†	3.70	3.60
No. 28	2.50	4.05†	3.85	3.75
Galvanized				
No. 10	2.10	3.65†	3.20	3.35
Nos. 12 to 14	2.20	3.75†	3.40	3.40
No. 16	2.30	3.85†	3.50	3.50
No. 18	2.40	4.00†	3.65	3.65
No. 20	2.60	4.15†	3.80	3.80
No. 22	2.65	4.20†	3.85	3.85
No. 24	2.80	4.35†	4.00	4.00
No. 26	3.05	4.60†	4.25	4.25
No. 28	3.30	4.85†	4.50	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness— Inches	B.w.g.	Outside Diameter in Inches— ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin.. round or hexagon	3.40	3.40	3.35
Cold fin., flat or square	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.00	4.00	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, $\frac{3}{16}$-in. thick by ¾-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ¼, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			10.50
Tin, Straits, pigs, New York			25.00
Lead, pigs, E. St. Louis	3.60	New York	4.75
Zinc, slabs, E. St. Louis	3.30	New York	4.50

	New York	Cleveland	Chicago
Antimony, slabs	9.50	10.00	10.75
Copper sheets*	19.62½	19.37½	19.37½
Copper wire*	11.00	11.00	11.37½
Copper, drawn, round*	18.12½	18.37½	17.87½
Copper tubing*	22.12½	21.87½	21.87½
Brass sheets, high*	16.87½	16.75	16.75
Brass tubing, high*	21.75	21.62½	21.62½
Brass rods, high*	15.12½	15.00	15.00
Brass wire, high*	17.25	17.25	17.25

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%, f.o.b.	24.00	24.30	23.30
Zinc sheets (casks)	9.00	10.50	10.50
Solder (½ and ½)	20.37½	21.50	18.00
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			41.50
Commercial genuine, intermediate grade			32.75
Anti-friction metal, general service			28.00
No. 4 babbitt, f.o.b.			9.00

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.00	7.50	6.75@ 7.25
Copper, heavy, and wire	6.50	7.00	6.25@ 6.75
Copper, light, and bottoms	5.50	6.00	5.50@ 6.00
Heavy lead	2.00	3.25	2.50@ 3.00
Lead battery plates	1.12½	2.00	1.75@ 1.87½
Brass, heavy, yellow	3.75	4.25	4.00@ 4.25
Brass, heavy, red	6.00	6.75	5.75@ 6.25
Brass, light	3.00	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.00	4.50	4.00@ 4.50
Zinc	1.00	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.13	$0.13
Cotton waste, colored, per lb.	.05½@.09	.09	.09
Wiping cloths, colored, per lb.	.10	.08	.09
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.097	.099	.102
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.35	.36	.24
Belting—Discounts from list:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30-10%	30-10%	50%
Med. grade, heavy wgt.	30%	30 -5%	40%
Rubber transmission—List price, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60-10-10%	50-10%	60%
Second grade	70-10%	60- 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.029	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1512½	.1587½	.18
Solder (½ and ½)	per lb.	.2037½	.2162½	.2575
Cotton waste, white	per lb.	.07@.11	.07@.11	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.35	.33	.33
Belting, leather, medium	off list	30-10%	30-10%	30-10%
Machine bolts, up to 1x30 in., full kegs	off list	65%	65-10%	50-10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.50
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.00
Structural, round head, broken kegs, net	4.50
Tank, 7/8-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20-10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$9.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Conn., Bridgeport—Jenkins Valve Co., 510 Main St.—10 ton crane for proposed 1 story, 65 x 65 ft. plant on Railroad Ave.

Mass., Cambridge (Boston P. O.)—Austin Ford & Son, Main St.—caterpillar tractor crane, gasoline driven, 30 ft. boom, 5 ton capacity.

O., Bluffton—Bd. of Education, Bluffton-Richland Village School District, A. D. Hall, Clk.—machine lathe, wood lathes, drill press, grinder, band saw and jointer for work shop for proposed 3 story, 81 x 194 ft. high school in Allen County. Estimated cost $250,000.

Pa., Springdale—Springdale Foundry Co., G. Chismark, Secy., 7th and Mill Sts., Tarentum—10 ton overhead crane for proposed 1 story, 50 x 130 ft. foundry on Butler St. here.

Ont., Hamilton — Polymet Mfg. Corp., 929 East 134th St., New York, N. Y.—machinery and equipment for the manufacture of condensers, transformers and coils for recently acquired factory building at Catharine and Jackson Sts.

Opportunities for Future Business

Calif., Salinas—City awarded contract for the construction of a machine shop.

Conn., Bridgeport—Jenkins Valve Co., 510 Main St., had plans prepared for the construction of a 1 story, 65 x 65 ft. addition to plant on Railroad Ave. Estimated cost to exceed $40,000, including equipment. Lockwood Greene Engineers, Inc., 100 East 42nd St., New York, Archts. and Engrs.

Conn., Meriden—Bd. of Trustees, Industrial School for Boys, E. King, Pres., awarded contract for the construction of a group of buildings, including service building, work shop, garage, administration building, etc. Estimated cost $670,000. Noted May 7.

Ill., Kenilworth — New Trier High School, Winnetka, awarded contract for a 4 story addition to high school, including machine shop, etc., here. Estimated cost $850,000.

Ill., Ottawa—Bd. of Education, C. H. Kingman, Secy., 211 East Main St., plans the construction of a 2 story manual training high school. Estimated cost $200,000. J. C. Llewellyn & Son, 38 South Dearborn St., Chicago, Archts.

Ia., Des Moines—Interstate Transit Lines, 422 Grand St., plans the construction of a 1 and 2 story bus station at Fourth St. and Court Ave. Estimated cost $40,000. R. E. Sawyer, 601 Flynn Bldg., Archt.

Ia., Maquoketa—D. W. Burch, Maintenance Supt., 339 Old Masonic Temple, Davenport, will receive bids until May 22 for a maintenance garage here.

Ia., Rockwell City—A. A. Baustian, Storm Lake, Dist. Engr., will soon award contract for the construction of a maintenance shop here.

Kan., Bethel—Bd. of Education Dist. No. 2, Wyandotte County, c/o H. J. Perry, Rural Route 4, Kansas City, will soon award contract for the construction of a 2 story, 153 x 248 ft. rural high school, including machine shop, administration building, etc., on Leavenworth Rd. here. Estimated cost $150,000. Peterson & Almon, 509 Huron Bldg., Kansas City, Archts.

Mass., Jamaica Plain (Sta. Boston)—Boston Consolidated Gas Co., 250 Stuart St., Boston, awarded contract for a 5 story warehouse, garage and service building at McBridge, Washington and Water Sts. here. Estimated cost $50,000.

Mass., Norfolk—Dept. of Correction, is having sketches made for the construction of a shop building at State Prison Colony. Estimated cost $40,000. McLaughlin & Burr, 88 Tremont St., Boston, Archts.

Mass., Quincy (Boston P.O.)—Louis Epstein Radiator Repairing & Plating Co., 130 Washington St., awarded contract for a 1 story repair shop and office. Estimated cost $40,000.

Mass., Quincy (Boston P.O.)—Quincy Oil Co., 57 Federal Ave., plans a shop, garage, office and tanks for oil terminal. Estimated cost to exceed $40,000. G. E. St. Laurent, c/o owner, Archt.

Mass., Salem—Estate of M. M. Creedon, P. Creedon, in charge, 428 Essex St., is receiving bids for addition and alterations to service garage at 430 Essex St. Estimated cost $40,000. Andrew, Jones, Biscoe & Whitmore, 50 Congress St., Boston, Archts.

Mass., Springfield—R. Bennett, c/o American Wrecking Co., 23 Hannon St., will build a 1 story garage at 208 Sharon St. Estimated cost $50,000. Private plans. Work will be done by day labor.

Mass., Taunton—Taunton Pearl Works, 35 Vernon St., is having revised plans prepared for remodeling 2 story manufacturing building. Estimated cost $50,000. Jackson & Moreland, Park Sq. Bldg., Boston, Archts. Noted Mar. 12.

Mass., Watertown (Boston P.O.)—D. A. Papalia, 129 Waverly Ave., awarded contract for the construction of a 1 story garage and repair shop at 117 Waverly Ave. Estimated cost $40,000. Noted April 30.

N. J., East Orange—W. F. Bower, 437 Main St., Archt., is receiving bids for a 1 story, 100 x 100 ft. auto repair shop and laundry at Central and South Arlington Aves. for P. J. Bowers & Co., 189 Market St., Newark. Estimated cost $40,000.

N. J., East Rutherford—J. T. Camlet, 26 Piaget Ave., Clifton, Archt., will probably receive bids about June 1 for the construction of a 2 story, 30 x 70 ft. factory on Mozart St., for East Rutherford Syringe Co., 75 Mozart St. Estimated cost $40,000. Noted Mar. 12.

N. J., Hasbrouck Heights (br. Hackensack)—A. Cprnith, c/o Aitken Bros., 270 Terrace Ave., will not construct 2 story garage. $150,000. Project abandoned. Noted April 23.

N. J., Newark—Bd. of Education, City Hall, is having preliminary plans prepared for the construction of a 4 story junior and senior high school including manual training department, etc., on Chancellor Ave. Estimated cost $1,000,000. Guilbert & Betelle, 20 Branford Pl., Archts.

N. J., Newark—Fischer Auto Sales Co., 596 South 11th St., will build a 2 story, 60 x 135 ft. auto repair shop at 606-610 South 11th St. Estimated cost $40,000. R. B. Pryor, 11 Governor St., Archt. Work will be done by separate contracts. Noted April 30.

N. J., Newark—Voorhees, Gmelin & Walker, 101 Park Ave., New York, N. Y., Archts., will receive bids after June 1 (extended date) for a 6 story garage and warehouse at Loretta Ave. and Fabyan Pl., here, for New Jersey Bell Telephone Co., 540 Broad St., Newark. Estimated cost $750,000. Noted April 9.

N. J., Newark—Unique Art Mfg. Co., 196 Waverly Ave., postponed construction of 2 story factory. $100,000. S. Shaw & Co., 24 Commerce St., Archts. Project in abeyance. Noted May 7.

N. Y., Attica—Dept. of Correction, Capitol, Albany, awarded contract for the construction of a group of buildings including administration building, state shop building, shop building, textile shop building, maintenance storehouse and service connections at Attica State Prison here. $1,277,338. Noted March 5.

N. Y., Buffalo—Nickel Plate Development Co., Terminal Tower, Cleveland, O., awarded contract for the construction of two 2 story terminal warehouses. Estimated cost $300,000.

N. Y., New York—C. Ciampi Realty & Building Corp., 2095 Ryer Ave., is having preliminary plans prepared for a 2 story, 100 x 125 ft. service garage at Morris Park Ave. and Wyatt St. Estimated cost $60,000. M. Siegel, 1775 Broadway, Archt.

N. Y., New York—S. Cincelli, 2393 Arthur Ave., will receive bids late in August (extended date) for the construction of a 1 story, 90 x 119 ft. service garage at Hoffman and 184th Sts. Estimated cost $40,000. M. W. Del Gaudio, 545 5th Ave., Archt. Noted April 16.

N. Y., New York—Enavon Realty Co., 17 Leroy St., is having plans prepared for the construction of a garage and office at 18 Morton St. Estimated cost $150,000. M. W. Del Gaudio, 545 5th Ave., Archt. Maturity later.

N. Y., New York—Webster Auto Wrecking Co., Carter Ave. and 174th St., awarded contract for a garage and repair shop. Estimated cost to exceed $40,000. Noted April 10.

N. Y., Rensselaer—Sun Oil Co., 24 James St., awarded contract for the construction of a garage, warehouse, lubricating oil pump house, double loading rack, etc. Estimated cost $200,000.

O., Euclid (Br. Cleveland)—Addressograph-Multigraph Corp., Cleveland, is having preliminary plans prepared for a new factory here. Estimated cost $1,000,000.

O., Newton Falls—Newton Steel Co., E. F. Clark, Pres., First National Bank Bldg., Youngstown, plans altering and re-equiping rolling mill here. Estimated cost $1,000,000. Maturity indefinite.

Pa., Erie—Bd. of Education, R. S. Scobell, Secy., Library Bldg., awarded contract for the construction of a 1 story, 40 x 270 ft. addition to technical high school at 10th and Sassafrass Sts. Estimated total cost including equipment $55,044. Noted Mar. 26.

Pa., Erie—Jerry Quirk, 906 East 11th St., plans to rebuild planing mill and lumber yard recently destroyed by fire. Private plans. Work will be done by owner's forces.

Pa., Pittsburgh—F. Tinker & Sons, 5649 Berlin Way, (rolling mill supplies) awarded contract for a 1 story, 55 x 100 ft. factory at 5609 Butler St. Estimated cost $50,000. Noted May 7.

Pa., Springdale—Springdale Foundry Co., G. Chismark, Secy., 7th and Mill St., Tarentum, plans the construction of a 1 story, 50 x 130 ft. foundry on Butler St. here. Private plans. Maturity soon.

R. I., Providence—Tramonti Auto Supply, J. Tramonti, 361 Broadway, awarded contract for the construction of a 1 story garage. Estimated cost $45,000.

Tex., San Antonio—Bd. of Education, Lavaca and Water Sts., will receive bids after May 31 for additions and remodeling Main Ave. high school into vocational training school at Main and Romana Sts. Estimated cost $150,000. Phelps & DeWees, 628 Gunter Bldg., and H. P. Smith, National Bank of Commerce Bldg., Archts.

Va., Spotsylvania—Ballinger Co., 12th and Chestnut Sts., Philadelphia, Pa., Engrs., will receive bids until May 27 for the construction of a 2 story, 98 x 402 ft. addition to manufacturing plant for Sylvania Industrial Corp., Spotsylvania.

Ont., Brantford — Williams Tool Corp., 32 Bridge St., has secured manufacturing rights for a line of pumps made by National Acme Co., E. 131st St. and Coit Rd., Cleveland, O., and plans extensions to plant and installation of additional special equipment.

Ont., Hamilton—Anchor Cap & Closure Co., 22 Queens Blvd., Long Island City, N. Y., will not construct manufacturing and harbor development here. Project abandoned. Noted April 9.

Ont., Ottawa—J. Delfalco, 304 Preston St., awarded contract for the construction of a 1 story garage. Estimated cost $20,000.

Ont., Thorold—Ontario Paper Co., Allanburg Rd., awarded contract for a 2 story, 50 x 144 ft. machine shop as addition to plant. Estimated cost $75,000.

Ont., Willow Grove—Canadian Gypsum Co., H. O. 1221 Bay St., Toronto, awarded contract for the construction of a group of buildings, including 56 x 300 ft. sheet rock building, 50 x 156 ft. mill building, 40 x 42 ft. machine shop, 50 x 175 ft. warehouse, etc. Noted April 30.